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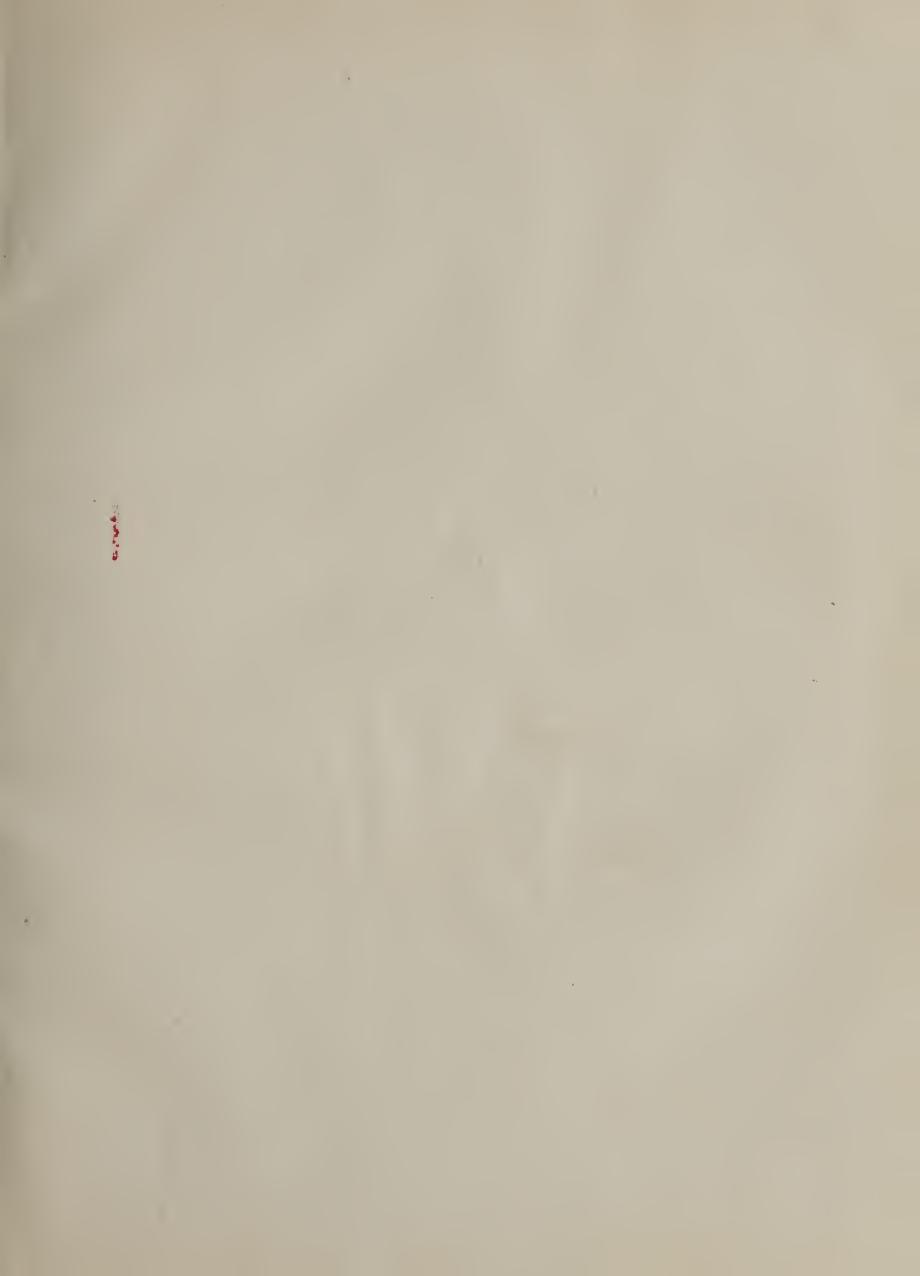


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UNITED STATES

DEPARTMENT OF AGRICULTURE

The Works of

Warner W. Stockberger (1872-1944)

with

Biographical Memoir

and

Bibliography

Volume II

Memorial Volumes

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man, and at every botanical gathering which included him he was a center of sprightly conversation and good feeling. These qualities, and his untiring and unselfish devotion to his work and to his students, developed for him an amount of personal affection and loyalty that was his chief possession. His place in American botany was sufficiently unique to remain vacant; and his personality will be still more impossible to duplicate.

A CONVENIENT TRAVELING BALANCE

(WITH TWO FIGURES)

In carrying out certain lines of investigation involving more or less travel, or the establishment of temporary stations remote from well-equipped laboratories, the lack of a compact and readily transportable balance, of a fair degree of sensitiveness, often seriously hampers the progress of the

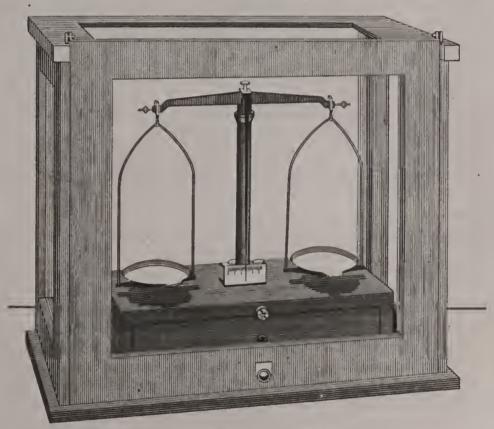


Fig. 1.—Balance set up within the closed case.

work. The ordinary balance inclosed in its glass case is too cumbrous and fragile to be readily transported, yet no dependable weighing can be made except upon a suitable balance properly protected.

[APRIL 1908

In preparing an outfit of apparatus for field use I have devised a convenient form of "knock-down" balance with collapsible case, which in great measure solves the question of a practicable field balance.

The balance proper and the case are entirely independent. reliable instrument maker I ordered a good type of laboratory balance fitted with the usual accessories but without the glass case. The pillar is fastened to the box with screws having milled heads and is readily removable. All the metal parts of the balance can be detached and packed safely in the drawer of the box.

The case for this balance is made in six sections, of which those forming

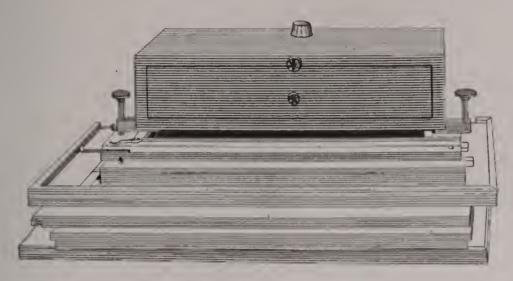


Fig. 2.— Case collapsed and balance packed.

the ends are secured in place on the base by dowel pins. The joints of the case are made dust proof by means of a tongue-and-groove fitting. The door is hinged at the upper corners by means of pivot hinges and swings outward. After all the sections are in place, complete stability is secured by means of small hooks and screw-eyes which lock the various parts together. Instead of glass, clear celluloid is used, which renders the case practically non-breakable.

Fig. 1 shows the balance set up within the case which is closed; fig. 2 shows the case collapsed and balance packed. The total weight of balance and case is approximately ten pounds, and in the collapsed form may readily be carried in a trunk or even in a suit case.—W. W. STOCKBERGER, Bureau of Plant Industry, Washington, D. C.



April, 1906.] Further Notes on Anthurus borealis.

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KEY TO OHIO ALDERS IN WINTER CONDITION.

WILLIAM C. MORSE.

Alnus Gaert. Shrubs or trees with alternate leaf sears, not 2-ranked, twigs brown with prominent scattered lenticels; terminal bud present with about 3 visible scales; axillary buds single, large and prominently stalked or minute and not stalked; leaf sears triangular to subcircular; bundle sears 3-5; stipular scars present; pith prominently 3 angled or Y-shaped; both staminate and carpellate catkins present all winter, carpellate catkins woody, cone-like.

1. Twigs glutinous, black or brown dotted, nearly glabrous or with a Twigs glutinous, black or brown dotted, nearly glabrous or with a few large scattered hairs, buds 4-5 lines long, stalks of the buds 2-3 lines long; staminate catkins dark purple; pedunele of fruiting catkins 2-6 lines long. A tree reaching a maximum height of 75 feet and a trunk diameter of 2½ feet; introduced.

A. glutinosa (L.) Medic. European Alder. Twigs coarsely pubescent, with comparatively few brown dots; buds 2-3 lines long; stalks of buds ½-1 line long; peduncle of fruiting eatkins 2-6 lines long. A native shrub or sometimes a small tree.

A. rugosa (Du Roi) Koch. Smooth Alder.

A. rugosa (Du Roi) Koch. Smooth Alder.

1. Twigs finely pubescent; buds 2-4 lines long; bud stalks ½-1 line long; fruiting catkins sessile or nearly so. A native shrub or rarely a small tree.

A. incana (L.) Willd. Hoary Alder.

FURTHER NOTES ON ANTHURUS BOREALIS.

W. W. STOCKBERGER.

In a recent note on Anthurus borealis Burt, (Ohio Naturalist 6:474, 1906) D. R. Sumstine states that he has not seen it reported from any other places than those localites in New York and Massachusetts recorded by Burt when he described the species in 1894.

Lloyd (Mycological Notes, No. 17, p. 183, 1894) acknowledges the receipt of some specimens collected by Beardslee near Cleveland, Ohio. Later a short account of the occurrence of Anthurus borealis in northern Ohio, by Beardslee, was published by the Ohio State Academy of Science (9th Ann. Rept. p. 19, 1901). The occurrence of this fungus at Granville, Ohio, was reported before the Ohio Academy at its annual meeting in 1901 (10th Ann. Rept. p. 20, 1902), and this station is further recorded in Lloyd's Mycological Notes (No. 19, p. 219, 1905) along with some previously unrecorded New England stations, one at East Hartford, Conn., one at Storrs, Conn., and several in Massachusetts.

Its further occurrence as noted by Sumstine would seem to indicate that this species of Anthurus does not occur so rarely as has been supposed, and that its occasional occurrence throughout Ohio may be safely predicted.

Washington, D. C., March 2, 1906.

BULLETIN

OF THE

SCIENTIFIC LABORATORIES

0F

DENISON UNIVERSITY.

THOMAS L. WATSON,

Permanent Secretary Denison Scientific Association

GENERAL INDEX TO THE FIRST TEN VOLUMES OF THE BULLE-TIN OF THE SCIENTIFIC LABORATORIES OF DENISON UNIVERSITY. FROM 1885 TO 1897 INCLUSIVE.

By W. W. STOCHBERGER

Granville, Ohio, August, 1904.



Stockberger, W. W.

General Index to the First Ten Volumes of the Bulletin of the Scientific Laboratories of Denison University. From 1885 to 1897 inclusive. Bulletin Scientific Laboratories of Denison University, Granville, Ohio, August, 1904, pp. 1-39.

General Index to the First Ten Volumes of the Bulletin Scientific Laboratories of Denison University. From 1885 to 1897 inclusive. By W. W. Stockberger. Bulletin Scientific Laboratories of Denison University, Granville, Ohio, August, 1904, pp. 1-39.

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GENERAL INDEX

TO THE

FIRST TEN VOLUMES

OF THE

BULLETIN

OF THE

Scientific Laboratories

OF

Denison University

From 1885 to 1897, inclusive.

BY W. W. STOCKBERGER.

All references are brought under one alphabet. Names of new species are followed by n. sp. Italicised page number indicates a reference to an illustration. The Roman characters I and H following the volume numerals 8 and 9 refer to the parts in which these volumes were issued, a distinction not observed in the other volumes since the pagination of each is consecutive. Figures not referred to in the text are indexed by number of volume and plate. The letter T preceding a numeral refers to the tables in Vol I.

Note: Plates VIII, XV, and XVI of Vol. II were issued as the last three plates in Vol III.

Plate XI, wanting in Vol. III, appears as plate of same number in Vol. IV.

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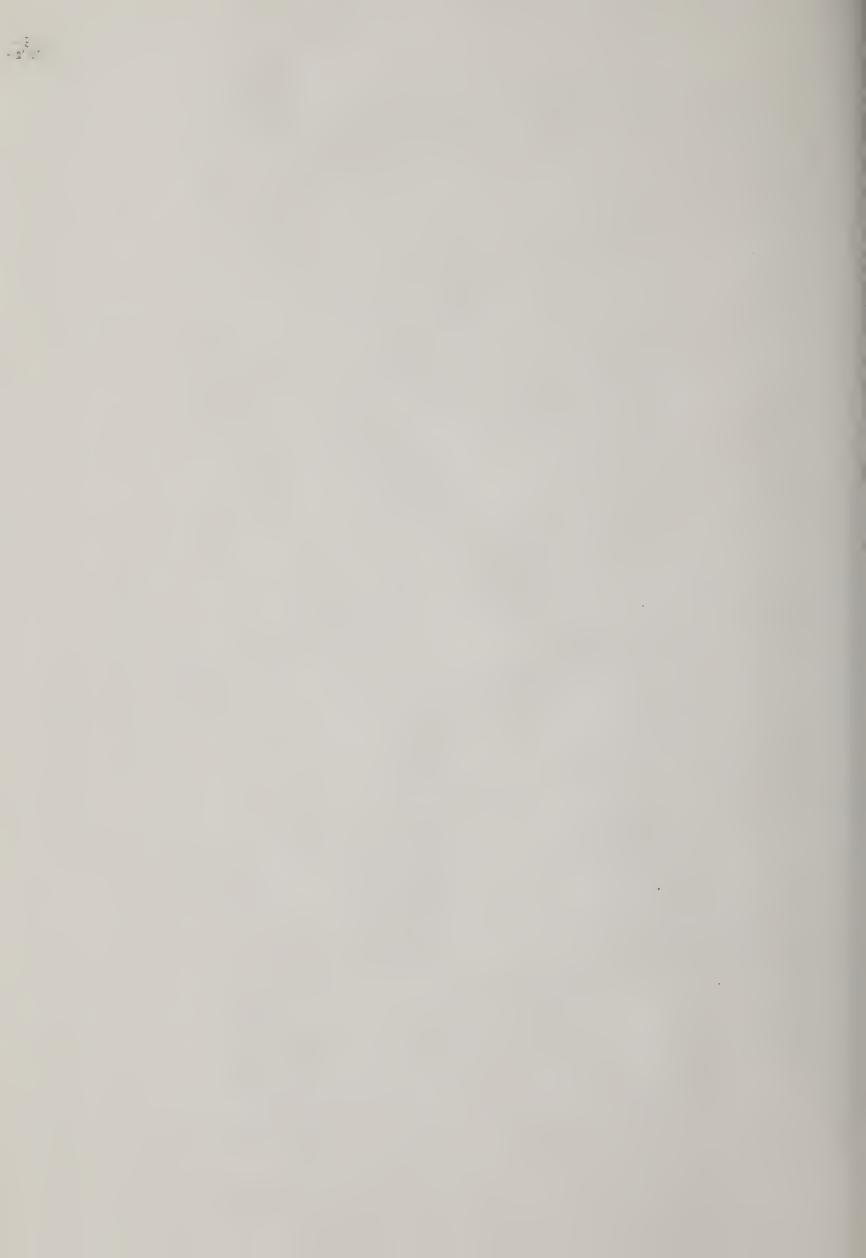
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Plants Poisonous to Livestock Found on Southwestern Ranges

W. W. STOCKBERGER AND W. W. EGGLESTON, Bureau of Plant Industry, U. S. Department of Agriculture

THE LOSSES to the livestock industry in the United States caused by range animals feeding on poisonous plants amount to several million dollars each year. These losses ill no doubt increase as the area of tock ranges grows smaller and overgrazing becomes more common, unless more stockmen learn to know the plants hich cause the heaviest losses and use after care in handling their animals in the range. In view of the large number of recognized poisonous plants it is a surprising that busy stockmen and right to distinguish all the different ands of plants which are known to be referred to the stockmen are few in number to stockmen are few in number das a rule are not difficult to recognized and the content of the stockmen are few in number das a rule are not difficult to recognized and the stockmen are few in number das a rule are not difficult to recognized poisonous plants.

lf with the principal poisonous ts in his locality, find out the places te they grow, the stage of growth n of the year in which they crous and so far as possible keep

his stock away from areas where harmful plants are common. The prevention of poisoning rather than the giving of remedies must be depended upon to reduce the losses caused by poisonous plants.

Plants Causing the Heaviest Losses.

The plants responsible for the heaviest losses of livestock on the southwestern ranges are loco, pingue, oak, milkweed and snakeweed.

and snakeweed.

A number of widely distributed poisonous plants belonging to the pea family are known under the general name of loco. In the Southwest loco does more damage to livestock than any other group of plants. The locoes are among the first plants to appear on the ranges, and thrive so long as moisture conditions are favorable. Although in some years the plants unusually abundant, in other years they are very scarce. In the fall if there is sufficient moisture, countless seedlings of loco appear on the ranges and following a favorable winter season these seedlings quickly develop into good-sized succulent plants before other forage is available. When this condition occurs serious losses of livestock are almost cer-

tain to result. The principal loco plants of the Southwest are as follows:

White Loco (Oxytropis Lamberti).

This plant is widely known as white loco since on many large areas it generally has white flowers, but in the Southwest the flowers are usually dark purple in color. It is also called "rattleweed' by stockmen in Arizona and New Mexico on account of the rattling sound made by the dry pods when the plants are disturbed. The white loco is stemless and this lack of a stem distinguishes it from the other important loco plans. The slender pods of the plant are inflated and woody.

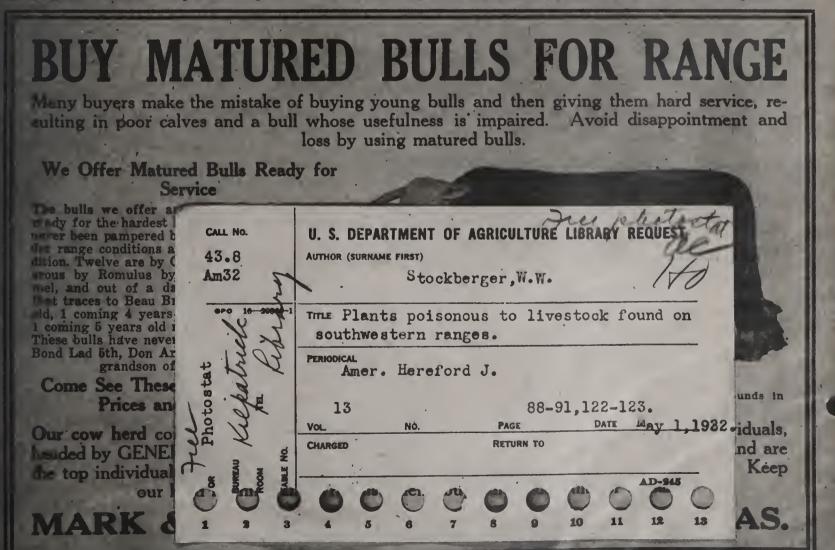
White loco occurs in the yellow pine belt from Western Texas to Arizona and is dangerous to all livestock on the range.

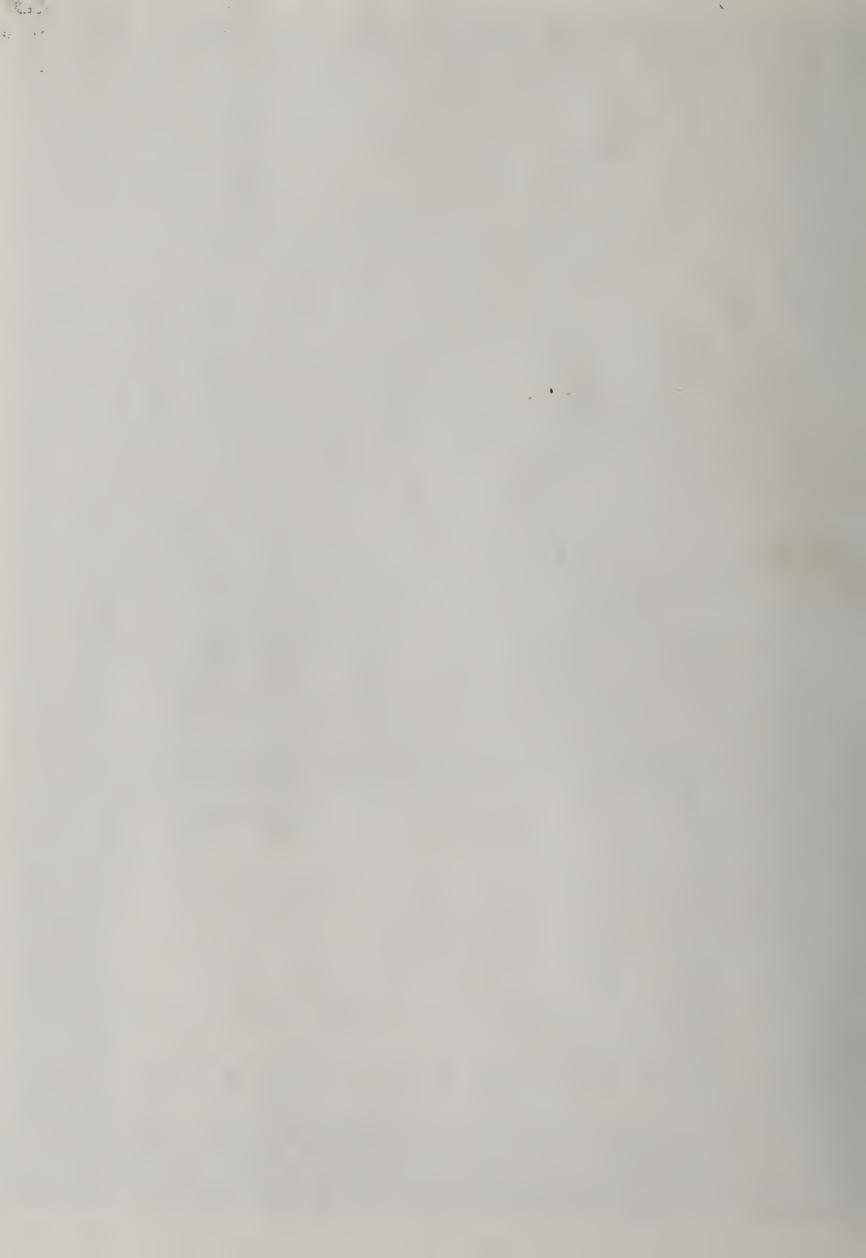
Blue Loco (Astragalus Allochrous). Woolly Loco (Astragalus Bigelovii).

These two locoes grow in the foothills and higher plains just below the yellow pine belt in Arizona and New Mexico. The stems of the Blue Loco are spreading and its flowers are purple, or yellow tipped with purple. The Woolly Loco has erect stems and bright purple flowers.

Rattleweed (Astragalus Diphysus.)

This loco grows on areas among the pinons of Arizonia and New Mexice at levels slightly lower than those occupied by the other species just mentioned. Rattleweed has stems which curve upward, white to purplish flowers and thin inflated bladder-like pods. Feeding experiments have shown this plant to be





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more poisonous to horses than to other range animals.

Pingue or Rubber Weed (Hymenoxys Floribunda).

Pingue is a strong-scented herb the roots of which live over winter and in

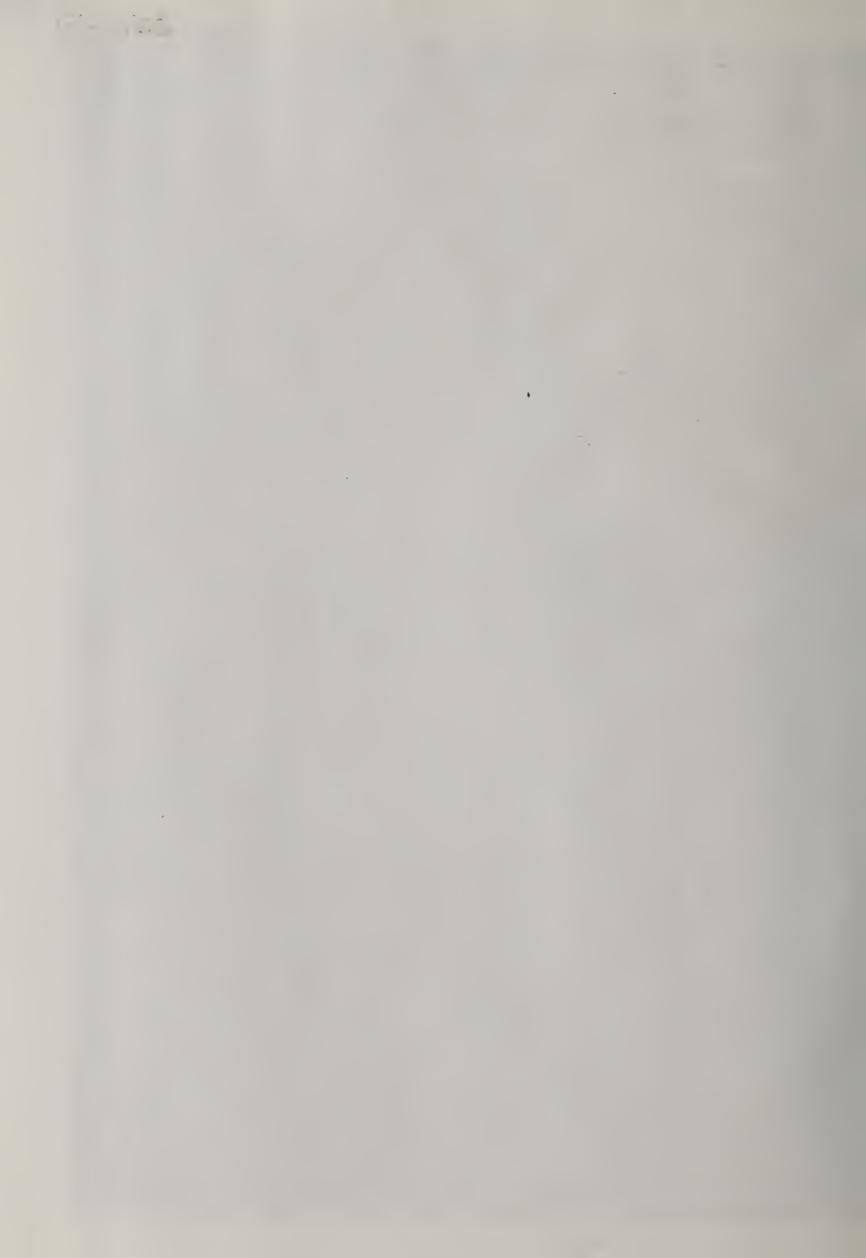
the spring send up several erect stems about one foot tall forming a compact c'ump. The stem bases are woody and covered with woolly hairs. The leaves are divided into several long and narrow divisions. Numerous small branches

arise from the upper part of the stems each bearing a yellow flower-head measuring about three-fourths of an inch

Pingue grows in the dry gravelly soil of the higher plains and foothills in the



STOCK-POISONING PLANTS FOUND ON THE RANGES OF THE SOUTHWEST. 1—Rattieweed. 2—Sneezew ed. 3—4—Choke Cherry. 5—Mexican Buckeye. 6—Coral Bean or "Mountain Laurel." 7—Pingue. 3—Rayless Gold nrod. 10—Rattle Rush. 11—Mexican Whorled Milkweed. 12—White Loco. 13—Whorled Milk eed.



vellow pine belt of Arizona and New Mexico. It causes heavy losses of sheep which often eat this plant when other feed is scarce.

Oak (Quercus Havardi and Species.)

The scrub oaks have a wide distribution on the ranges of the Southwest. They vary in form from low shrubs to small trees sometimes 20 feet or more in height. There are several species of scrub oak which may injure livestock but the better known ones are the "shinnery" oak (Quercus havardi) oak (Quercus havardi), a low shrub found in the sandhills of Southeastern New Mexico and Western Texas, and the "shin" oak (Quercus gambellii), a shrub or small tree found in the yellow pine belt of Northern New Mexico.

In the Southwest there are heavy losses of cattle from oak-leaf poisoning. The danger period begins in the spring when the oak buds start and lasts until other forage becomes available. Cattle may feed largely on oak with little danger of being poisoned provided they are able daily to get a few pounds of some other forage.

Milkweed.

Many different kinds of plants which have a milky juice are known locally as milkweeds. Some of these are harmless, although often believed to be poisonous. Among the harmless "milkweeds" are the wild lettuce, sow thistle and prickly the wild lettuce at the solution of poppy, which have alternate leaves, and the skeleton weed, or prairie pink, with almost leafless stems. The milkweeds to be feared by stockmen are those which have two or more leaves grouped together at the joints of the stem. One of these, known local'y as Dogbane or Indian Hemp, is rarely eaten by stock and apparently causes little if any damage. The milkweeds which are known to cause serious injury to livestock all belong to the true milkweed family. Those best known as poisonous in the Southwest are as follows:

Whorled Milkweed (Asclepias Galioides).

The whorled milkweed is an erect herb with one to several stems from one to four feet high springing up from horizontal roots. From two to six long narrow leaves occur at each joint of the stem. The greenish-white flowers occur at the ends of the stems and branches in clusters resembling those of the onion. The flowers have five divisions, to each of which is attached a hood and a slender horn. The seeds are produced in slender sharp-pointed pods one to three inches ong which when mature split lengthwise freeing the small, reddish-brown and downy seeds which are carried about by the wind.

In the Southwest the whorled milkweed is common in the plains and foot-hills from Western Texas to Arizona. It spreads rapidly along irrigating ditches and in cultivated lands under irrigation and is materially assisted in spreading by the methods of cultivation used in orchards. It does not readily invade established fields of alfalfa but is certain to cause troub'e when lands already infested with milkweed are sown to a'falfa. The plant is also spread by cultivation in fields where dry farming is practiced, and by animals along roads and trails and in bedding grounds.

This milkweed is dangerous to sheep cattle and horses and a relatively small quantity is sufficient to cause death.

Mexican Whorled Milkweed (Asclepias Mexicana).

This is a p'ant which resembles the whorled milkweed, but is distinguished from it by its greater size and broader leaves. It occurs in California but not in

the other range states of the Southwest, with the exception of Western Arizona.

The effect of this plant on animals is similar to that of the whorled milkweed but it is much less poisonous.

Common Milkweed (Asclepias Speciosa). This plant is distinguished from the whorled milkweeds by having two broad pointed leaves at each joint and large pink flowers. It is generally distributed throughout the southwestern states but

it is not known to cause much damage.

James' Milkweed (Asclepias Latifolia).

This species, unlike the other milkweeds, has stems which curve upward and two leathery broad and blunt leaves at each joint. It occurs on the high plains from Western Texas to Arizona and is dangerous to sheep and goats in early spring.

Spider Milkweed (Asclepiodora Decumbens).

This plant has long spreading stems with long leaves tapering to a point, and brownish flowers. It occurs in the high-er ranges from Western Texas to Arizo-na and is avoided by stockmen in spring.

Snakeweed (Gutierrezia Sarothrae). Snakeweed is a low, bushy, sticky herb about one foot tall, somewhat woody at the base with roots that live over from

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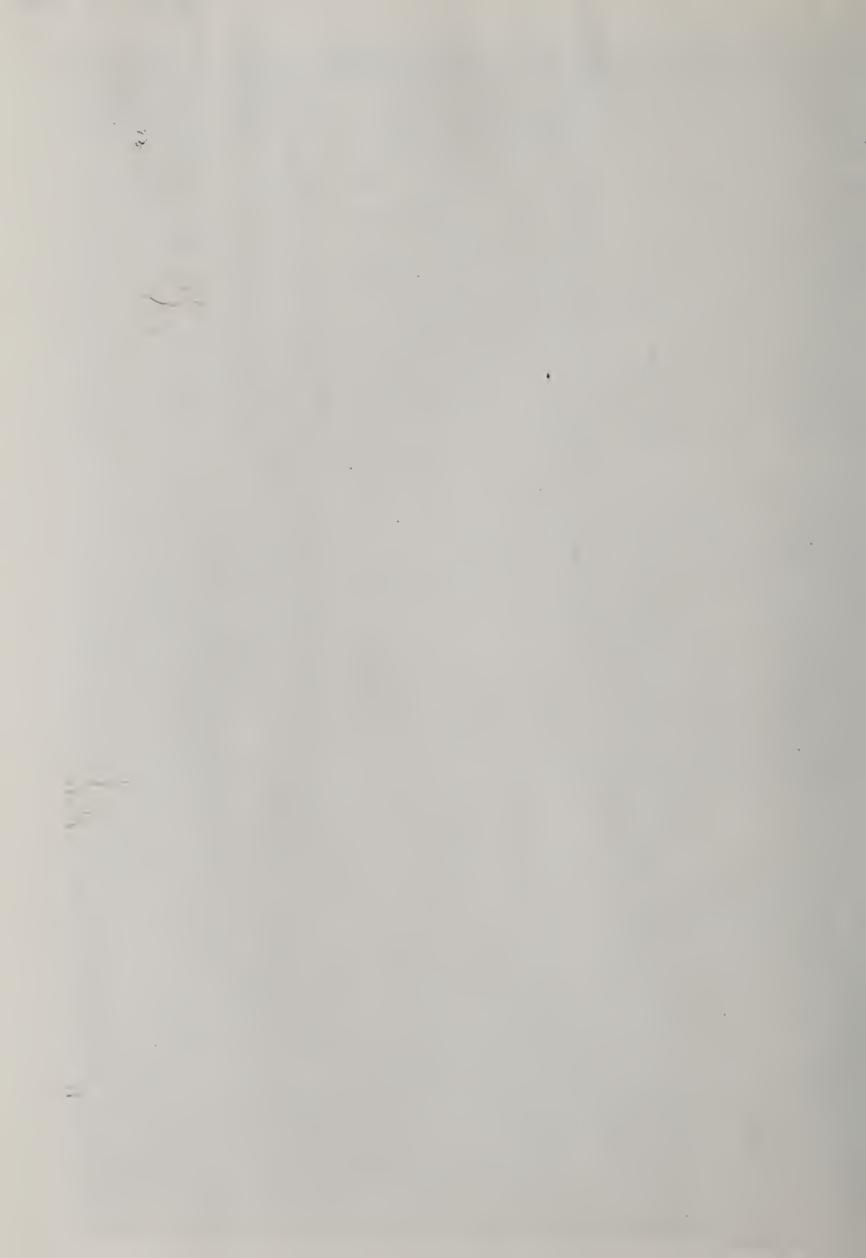
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year to year. The slender many-branched stems bear numerous light-green narr w and twisted leaves and many small ye low flower-heads which grow in dense cust rs. Snakeweed is found in the mich r plains and foothills from Texas to Arizona. It is practically certain to be found wherever pingue grows, but it a -o occurs on areas where pingue is not present. The plant is poisonous to sheep and is sometimes responsible for part the trouble known locally among the trouble known locally among e pien as "pingue poisoning.

Plants Causing Moderate Losses.

A number of other plants which are pol nous to grazing animals are found on the stock ranges of the Southwest. That they do not cause more injury is de in part to their limited distribution or their occurrence in areas where few animals are grazed. In some cases also the plants are dangerous only at certain periods of the year or are likely to be eaten in harmfu' amounts only at times when sufficient other feed is not avail-

Rayless Goldenrod (Isocoma Wrightii).

The rayless goldenfor is an with numerous stems usually one to two with numerous stems usually one to two The rayless goldenrod is an erect herb feet high growing in dense bunches feet high growing in dense bunches The stems are woody at the base and bear numerous narrow entire or toothed leaves. The yellow flowers are borne in numerous small heads which form flat-topped clusters. It grows most abundantly on the alkaline soil of the lower levels. This p'ant is called "iimm'e weed" by stockmen in the Gila Valley in Arizona. The area in which it is found extends from Western Texas across Southern New Mexico to Arizona. Horses, cattle and sheep may be poisoned by this plant. The cases of poisoning usually occur in winter when forage is scarce.

Baccharis (Baccharis Pteronioides).

Baccharis, which is called Yerba de Pasmo by Mexicans in the Southwest, is a low spreading evergreen and somewhat woody plant with sticky leaves and branches. Each summer new canes spring up from the lower part of the old stems. The new canes are one to two feet long and bear many small shining green leaves which remain fresh and ing green leaves which remain fresh and attractive after other plants have lost their 'eaves. The inconspicuous flowers produce small downy seeds which float about in the air like those of the thistle. The crushed plant has a strong and rather unpleasant odor.

Baccharis grows in gravelly or rocky soil on the warm slopes of the foothil's from the vicinity of Ash Fork, Ariz., to the Davis Mountains in Texas, and is regarded as dangerous to cattle from October to March.

Rattle-Bush (Daubentonia Longifolia). This is a rank-smelling shrub or small tree with leaves somewhat like those of the mesquite and locust. It has showy clusters of flowers, in shape resembling those of the sweet pea but varying in color from scarlet to yel'ow, and flattened four-sided pods which are two to three inches long. Cross-partitions separate the seeds in the pods which rattle when shaken. This plant is found on sandy soil along creeks, watercourses and roadways in the lowlands of eastern and southern Toyan where it is a read to the court of the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a read to the southern Toyan where it is a southern Toyan where the south southern Texas where it is spreading rapidly. Sheep and goats are often killed

by eating the pods and seeds The sea son of danger is in the winter when feed

Blue Larkspur (Delphinium Scopulorum).

The blue larkspur as well as many others is poisonous to stock. The plants vary from one to seven feet in height and occur as clumps here and there or sometimes in large masses. The flowers, which appear in midsummer, vary in column from pale blue to deep purple-blue. or from pale blue to deep purple-blue. The plant may be recognized by the similarity of its flowers and leaves to those of the common garden larkspur.

In the Southwest, the range of lark-spur extends from the yel'ow pine belt to the spruce belt of the higher mountains from New Mexico to California. It is dangerous to cattle from its appearance in the spring until after the seeds have ripened and fallen to the ground. After that it is a safe forage. Larkspur is not poisonous to sheep, and on the range horses never eat enough of it to be noticeably affected.

Coral Bean or "Mountain Laurel".

This is an evergreen shrub or small tree, with thick shiny dark-green leaves and showy strongly-scented violet-colored flowers which appear in e rly spring and in shape resemble the of the sweet pea. The hard woody pod, which are not easily opened, con in from one to eight large red seeds. which contain the larger number of somewhat resemble a section of a direction of large beads.

The plant is common on the Gulf Co. and in Southern Texas as far w Continued on Page 122.

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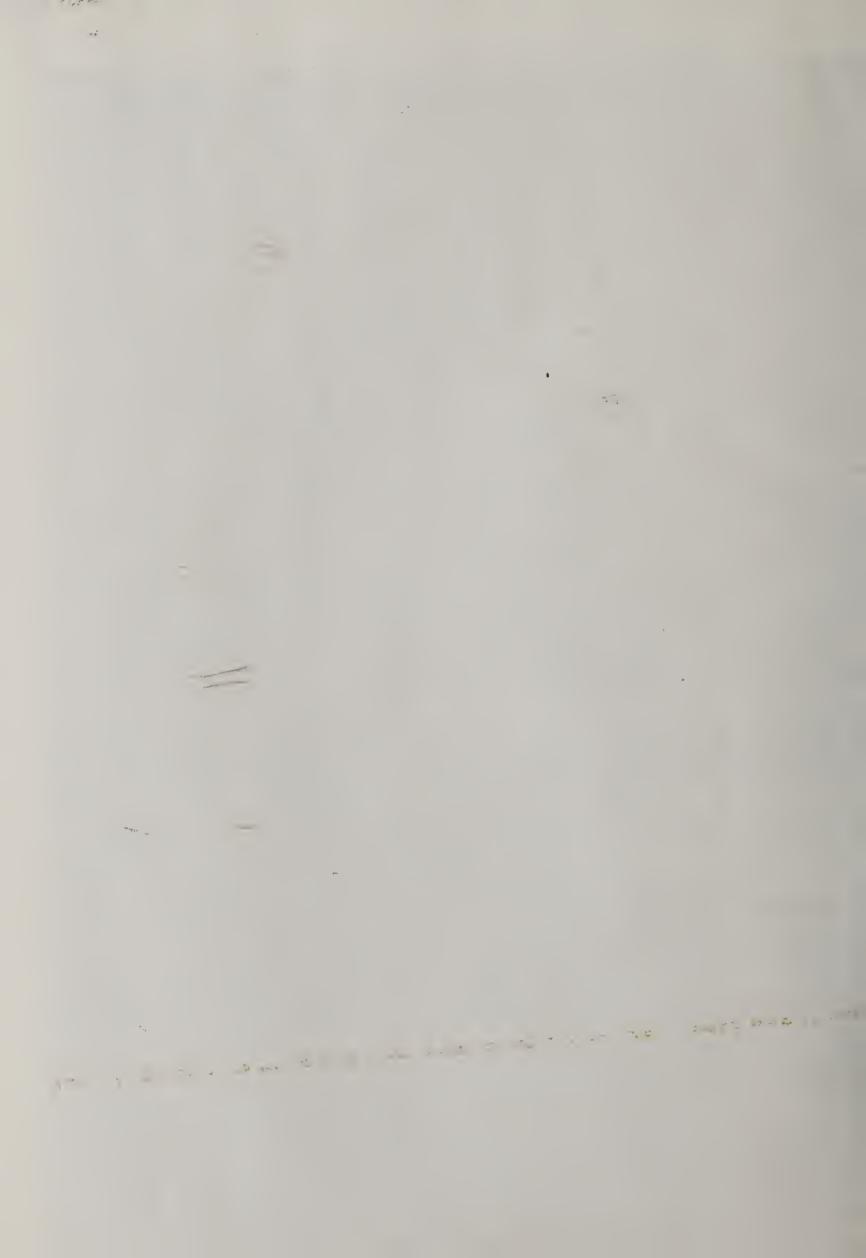
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Plants Poisonous to Livestock Found on Southwest Ranges

Continued from l'age 91.

the Pecos River. It occurs in less abundance in canyons from the Pecos to the Guadalupe Mountains in Southern New Mexico. The seeds of this plant contain

Mexico. The seeds of this plant contain an active poison and are generally regarded as poisonous to livestock.

Mexican Buckeye (Ungnadia Speciosa).

The Mexican buckeye is a wellknown shrub or very small tree of Southern

Texas. It has showy clusters of rose-colored flowers which appear just before colored fowers which appear just before or with the leaves. The tan-colored leathery pods are triangular in shape and usually contain three dark-brown shining seeds. The plant is common along streams and water-courses in the higher areas from the valley of the Trinity River through Western Texas to the Guadalupe Mountains in New Mexico. The seeds are poisonous and have been reported as dangerous to sheep and goats.
Sneezeweed (Helenium Hoopesii).

Sneezeweed somewhat resembles the wild sunflower, to which it is related. The roots of the plant live over winter and in the spring send up stiff leafy stems, one to three feet tall, which bear one or more flower-heads measuring two to three inches across. The thick darkgreen leaves are long and pointed. The disk, or central part of the flower heads, is brownish-orange in color, the outer portion an orange-yellow. From the color of the flowers the plant is often called "yellowweed." On over-grazed ranges sneezeweed spreads very rapidly and in cases takes practically full possession of the soil.

This plant is common in canyon bottoms in the higher mountains of Arizona and New Mexico and in the Kern River watershed in the Sierras of Southern California. It is poisonous to sheep and cat-tle and is dangerous during the entire grazing season.

Coyotillo (Karwinskia Humboldtiana).

This is a small shrub growing two to three feet high with opposite conspicuously veined leaves which closely resemble those of the buckthorn. It bears numerous small greenish flowers which are followed by hard dry brownish-black berries. The plants do not all flower at once and as a result both flowers and ripe berries may be found at the same time during much of the grazing sea-son. It is a common plant in the ravines of the arid belt of Texas south of the tree region.

Coyotillo is poisonous to goats, sheep, and hogs. The berries are generally regarded as the harmful part of the plant. Choke Cherry (Prunus Virginiana). Black Cherry (Prunus Serotina). In the Southwest the choke cherry is

a wel'known shrub growing in the yellow pine and aspen belts of the higher mountains. The black cherry is a tree found along streams and in canyons of the mountains from Southern Arizona eastward. Range animals when hungry will browse on the leaves and young twigs of the wild cherry, often with fatal results. Poisoning is due to prussic acid which develops in the leaves after they haye been eaten.

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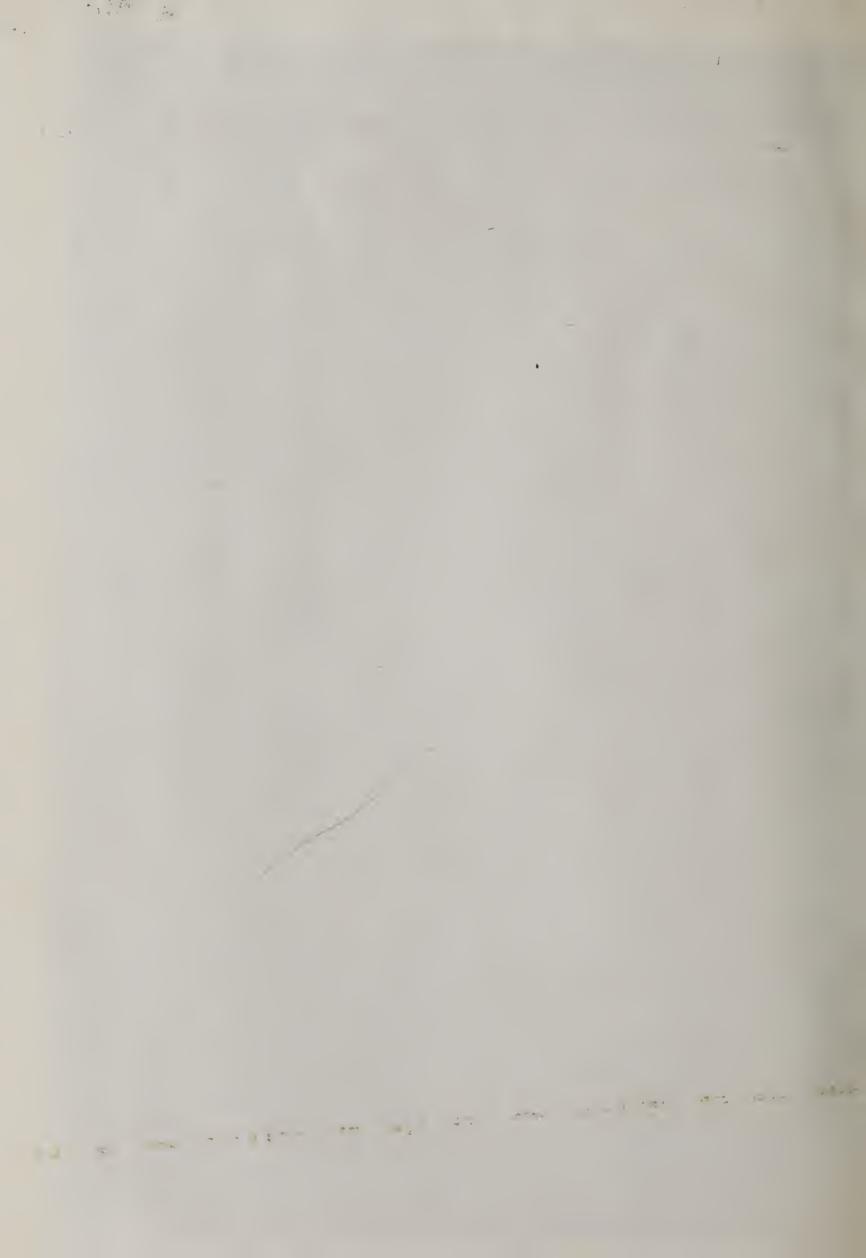
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scription is hardly necessary. It may be recognized by the smooth, stout 'eafstalk which divides into three branches at a point one or two feet from the ground and by the roughly triangular leaf which measures from one to two feet across. It is abundant in some localities in the yellow pine and aspen belts of the mountains of New Mexico and Arizona.

The bracken fern is poisonous to cat-

The bracken fern is poisonous to cattle, horses and sheep.
Bulletins Every Stockman Should Have.
The agricultural experiment stations in several of the grazing states, as well as the U. S. Department of Agriculture, have issued numerous bulletins which give detailed practical information about the poisonous plants causing livestock the poisonous plants causing livestock losses and suggest methods by which losses may be greatly reduced. The following bulletins will be found useful by every man hand ing livestock under open-range conditions:

range conditions:
"Range Plants Poisonous to Sheep and
Cattle in Nevada," Bulletin No. 95, 1918,
Agricultural Experiment Station, Reno,

Nevada.

"Colorado Plants Injurious to Live Stock," Bulletin No 211, 1915, Agricultural Experiment Station, Fort Collins,

Colorado.

"Stock Poisoning Plants of California,"
Bulletin No. 249, 1915, Agricultural Experiment Station, Berkeley, California.

"Poisonous Plants of Wyoming," Bulletin No. 126, 1921, Agricultural Experiment Station, Laramie. Wyoming.

"The Principal Stock-Poisoning Plants of Oregon," Bulletin No. 187, 1922, Agricultural Experiment Station, Corvallis,

cultural Experiment Station, Corvallis, Oregon.

"Stock Poisoning Plants of the Range," Bulletin No. 575, 1918, U. S. Department of Agriculture, Washington,

Herefords Bring the Price.

Herefords Bring the Price.

We know of no pleasanter reading for rainy days than the first column of the first page of a Chicago market paper. It is in that column that the performances of market cattle in the greatest market of the world are chronicled. For instance, we pick up the Chicago Daily Drovers Journal for April 25 and salve our eyes with the following: "Yearlings sold rapidly when they were available. A load of Hereford steers and heifers from Illinois averaged 811 pounds and sold to the Illinois Packing Company at \$8.75. There were several sales around \$8 to \$8.50. Steers sold at a top of \$9 today. Swift paid that price for a load of I linois Herefords averaging about 1,400 pounds. Three leads of 1,569-pound Herefords sold for shipment to Boston at \$8.90. Herefords sold to Swift at \$8.85. South Dakota Herefords, averaging about 1,460 pounds, sold to Morris at that price. Armour paid that for 1,383-pound Herefords from Illinois."

Reported Rates Will Be Reduced.

Welcome news for all livestock men came out of Washington April 25, when it was learned from official sources that a general reduction in railroad rates will be announced within a short time. President Harding has been strongly urging the Interstate Commerce Commission to expedite action. He feels that a rate reduction is imperative before a real industrial and economic recovery can be expected in the country.

BEAU BLANCHARD 48TH FOR SALE

Benu Blanchard 48th, calved Aug. 19, 1918, is a son of Heau Blanchard. His dam is the granddam of Beile Blanchard God, the 1918 international grand champion female. He is a lowest, thick, blocky bull that weighs a ton and has two good ends. He is considered by good judges to be one of the best sons of the old sire Beau Blanchard. He is a perfect breeder and good enough to head any herd. In fact he is a show bull. My reason for selling him is that I am keeping his full brother. Beau Blanchard 93d. My herd is too sinsii for two herd bulls. My price on him is very reasonable.

E. E. DOWIS, R. S. SHERIDAN, MO-Mendow Brook Stock Farm-

BLUE RIBBON HERD

Linebred Anxiety Herefords, through the grand champions, Prime Lad and Gay Lads.

BULLS IN SERVICE— the Champions

GAY LAD 6TH 809028, GAY LAD JR. 787079 AND LOVIE'S LAD 987389

A few real choice herd bulis for sale.
These are usually large for age, blg
boned, rich red color, aimost perfect
markings. Also a few bred and open
helfers.

C. M. LARGENT & SONS MERKEL, TEX.

BULLS WANTED

I want one or two cars good buils, a serviceable age, in condition for service. Have three haif-section farmin famous Spearman wheat belt trade any one of these for buils. Wou take some females. These farms are spiendld wheat land, priced so they are good interest-bearing investments, an will bear closest investigation. Full oright with each. Wart immediate livery on any buils traded for.

I full information. address

H. B. HART, Spearman, Tex.

FOUR GOOD BULLS

2 Choice herd bulls—DALE FAIRFAX 2D, 4 years bid, by Dale Fairfax and JUNIOR MISCHIEST 12TH, coming two, by Jr. Mischief. Also 2 good ran bulls by Dale Fairfax 2d. Priced to sell.

WM. SCHWAB, COON RAPIDS, IA.

CHOICE POLLED BULLS AND HEIFERS FOR SALE

10 rugged bulls and 12 quality heife s, all double standard and all co ing 2 years old. Herd headed by a o tstanding son of ECHO MISCHI tof a Reau Mischlef dam. Priced to s ll.

PURCELL BROS., Route 4, DENGON, IA.

Good Hereford Blood Score

E. M. Lynch, Axtell, Kas., toppe t
Kansas City market April 25 wit 1. d
of Hereford yearling steers and
they sold for \$8.35 a hundred and
700 pounds. These yearling
sired by a grandson of old Be u
dent and were out of grade
cows. with exception of a fe
purebreds. They were sold by
inson-Hoover Commission Co. inson-Hoover Commission Co.



RELATIVE PRECISION OF FORMULÆ FOR CALCULATING NORMAL PLOT YIELDS.¹

W. W. STOCKBERGER,

BUREAU OF PLANT INDUSTRY, U. S. DEPARTMENT OF AGRICULTURE.

The literature regarding field experiments with certain of our older agricultural crops is exhaustive, although it is often far from being convincing. The multiplication of experiments has as a rule only increased the number of negative or contradictory results, especially in those cases in which the yield of the crop has been the criterion. The different conclusions which have been reached respecting the effect of applying fertilizers to a crop under supposedly comparable conditions are certainly due in part to the failure systematically to study the possible sources of error, and in part also to the complaisant acceptance of working formulæ at their face value.

In attempting to interpret the somewhat extensive data collected from a series of field experiments with hops extending over a period of six years, advantage was taken of the opportunity to contrast the calculated "normal" and corrected yields on numerous test plots with the actual yields obtained therefrom. These comparisons may prove to be of some general interest or value to workers with crop plants although, in a strict sense, they apply only to a very limited area of a specific crop.

THE NORMAL YIELD OF CHECK PLOTS.

The object of a great many field experiments is to determine the effect of some special treatment upon yield. The practice is quite general to except from special treatment every third, fourth, or fifth row or plot on the experimental area, as checks for use in calculating a standard or normal yield for the treated plots. Numerous formulæ have been proposed for calculating the normal yield from that of the checks, and several of the formulæ in most frequent use have been briefly discussed by Olmstead in his article on Some Applications of the Method of Least Squares to Agricultural Experiments.² However, there seems to be a lack of published information on the

¹ Presented at the twelfth regular meeting of the Washington Section, American Society of Agronomy, Washington, D. C., February 25, 1916.

² Jour. Amer. Soc. Agron., 6: 190–203. 1914.

relative precision of these formulæ and on their absolute precision in specific cases with a definite crop plant, and the desirability of securing evidence on this point is apparent. For this purpose some data obtained in the Sacramento Valley of California from 30 consecutive rows of hops during the six years, 1909 to 1914, were used as a basis for calculating normal yields by five different formulæ. The rows were each 210 feet in length, and the plants in these rows averaged well in number and in uniformity of growth with the plants on several hundred acres of hops in the midst of which the experimental area was located. Since the actual or uncorrected yields of these rows furnish the basis for all the calculations referred to throughout this paper, they are presented in full in Table 1.

Table 1.—Yield, in pounds, of hops from 30 consecutive rows each 210 feet in length.

Row No.	1909	1910	1911	1912	1913	1914
I	139	123	260	100	137	73
2	128	110	212	158	144	152
3	135	117	235	154	137	119
4	137	118	215	165	144	147
5	155	127	262	187	176	141
Mean	139	119	237	153	147	126
6	157	129	247	230	145	167
7	205	169	264	220	146	145
8	188	172	300	220	163	180
9	253	192	330	223	211	167
10	135	140	244	262	130	101
Mean	188	160	277	231	159	170
II	189	189	282	133	171	III
12	239	213	315	263	160	161
13	192	197	255	238	171	209
14	179	183	269	231	197	169
15	214	164	251	218	192	204
Mean	202	189	274	217	178	171
16	240	195	273	229	239	200
17	179	145	267	270	210	252
18	167	162	199	228	178	216
19	186	195	282	207	253	227
20	164	176	266	269	236	214
Mean	187	175	257	240	223	222
21	127	157	214	245	216	231
22	146	166	270	208	257	211
, 23	157	167	246	274	192	268
24	158	149	283	195	207	163
25	157	144	241	194	206	216
Mean	149	157	251	223	215	218
26	161	149	266	199	206	185
27	159	143	282	176	222	214
28	150	156	300	163	197	168
29	130	138	243	173	162	205
30	140	161	264	131	162	153
Mean	148	149	271	168	190	185
Mean of all rows	169	158	261	205	185	182

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The normal yields calculated for the year 1913 from the data in Table 1 are shown in Table 2.

Table 2.—Calculated normal yields of hops in 1913, to show relative precision of various formulæ in calculating normal yields of test rows.

							Formula	e used.a	;			
Řow No.	Check or test.	Actual yield in pounds	c_1+c_2	$\frac{.c_n}{}=N$	1 C1 + 2	$=\mathcal{N}(A)$	$\frac{1}{2}(c+\frac{2}{3}+\frac{1}{3}c)$	$c_1 c_2 = N$	$\frac{1}{2}(c+c)$	=N(A)	p1+1	$\frac{1}{3}c_2 =N$
			Yie d.	Devia- tion.	Yield.	Devia- tion.	Yield.	Deviation.	Yield.	Devia- tion.	Yield.	Devia- tion.
I	C_1	137		§								
2	A	144	188	+44	139	— 5	163	+19	162	+18	151	+ 7
3	B	137	188	+51	141	+ 4	164	+27	166	+29	152	+15
4	C_2	144										
5	D	176	188	+12	144	-32	166	-10	166	-10	155	2I
6	E	145	188	+43	145	0	166	+21	167	+22	155	+10
7	C_3	146										
8	F	163	188	+25	140	-23	164	+ 1	167	+ 4	152	11
9	G	211	188	-23	145	- 66	166	- 45	159	-52	155	-56
10	C ₄	130				0						
II	H	171	188	+17	153	-18	170	— I	159	-I2	161	-10
12	I	160	188	+28	157	- 3	172	+12	179	+19	164	+ 4
13	C_5 J	171	****							T 0		
14	K	197	188 188	- 9	193	- 4	190	- 7	179	-18	191	- 6
15 16	C_6	192		- 4	216	+24	202	+10	213	+21	209	+17
17	L	239 210	188	-22	243	+33	215	+ 5	213	+ 3		
18	M	178	188	+10	248	+70	213	+40	220	+42	229	+19
10	C_7	253			240	1 /0		1 40		1 44	233	+55
20	N	236	188	- ₄₈	254	+18	221	-15	220	-16	237	+ 1
21	0	216	188	-28	255	+39	221	+ 5	222	+ 6	238	+22
22	C ₈	257			-33							
23	P	192	188	- 4	240	+48	214	+22	222	+30	225	+33
24	Q	207	188	-19	223	+16	205	- 2	197	-10	214	+ 7
25	C_9	206										
26	R	206	188	-18	203	- 3	195	-11	197	- 9	199	— 7
27	S	222	188	-34	200	22	194	-28	192	-30	197	-25
28	C_{10}	197]					
+Devi	ations.			230		252 176		162 110		194		190
			(T2 20	-	(T2 70		(8 20%		(10.40	157 %) 351		136
			(23.3/	0)449	(12.//	0)420	(3.3 /0	, 201	(10.4)	0/331	(9.0 /0	7 320

^a In these formulæ, c equals average yield of all the checks; c_1 , c_2 , etc., equal yield of checks C_1 , C_2 , etc.

The rows which are numbered from I to 28 were consecutive, and all received the same treatment. With the actual data on yield in hand for all the rows, every third row, Nos. I, 4, 7, etc., was arbitrarily assumed to be a check, and the normal yield was calculated for the intervening rows. The normal yields determined according to the several formulæ are given in the columns headed "Yield" in the

table. The deviations of the theoretical normal yield of each plot from the actual yield of the same plot are given in the columns headed "Deviation." At the foot of the table are given the totals of the plus and minus deviations respectively, and also the sum of all the deviations without regard to sign. The total deviations are expressed as percentages of the total actual yields of the assumed test plots, A, B, D, E, etc., and since the deviations under the several formulæ are in each case calculated on a common basis, these percentages are strictly comparable and should indicate the relative precision of the several formulæ.

For the year under consideration the third formula shows the smallest percentage deviation, and it would seem to follow that the normal yields determined by the use of this formula should differ least from the actual yields. However, a study of the deviations row by row shows that this is true in five instances only, rows D, F, H, O, and Q, while in seven individual cases, rows A, B, E, I, J, R, and S, the second formula gives results which differ least from the actual yields. On considering next the results which are second in order of difference from the actual yields, it appears that six such cases, rows G, K, L, M, N, and P, occur under the third formula and nine rows, A, B, E, H, I, J, Q, R, and S, respectively, occur under formula No. 5. These discrepancies illustrate clearly the false inferences which may be readily drawn from a consideration of averages alone. Moreover, it requires but little imagination to picture the absurd conclusions that may be and perhaps have been drawn from results obtained by the use of one or the other of these formulæ. To make this concrete, suppose these assumed test rows had received a treatment different from that given the checks, and suppose further that the yield of row A had been actually increased by the treatment to the extent of 30 pounds. Using the new value for the yield of row A, 174 pounds, and the theoretical normal as determined by the formulæ, the conclusions to be drawn respecting the effects of different treatment are as follows:

From formula 1, the treatment decreased the yield 14 lbs. below normal. From formula 2, the treatment increased the yield 35 lbs. above normal. From formula 3, the treatment increased the yield 11 lbs. above normal. From formula 4, the treatment increased the yield 12 lbs. above normal. From formula 5, the treatment increased the yield 23 lbs. above normal.

Another inherent weakness of these formulæ becomes apparent when the comparisons illustrated in Table 2 are repeated upon other data. Each change in the data which serves as a basis for the calculations brings about corresponding changes in the ratio between the percentages which indicate their apparent relative precision. Use was made of the actual yield in pounds from the same 28 consecutive rows for each of the 6 years, 1909 to 1914. Calculations similar to those shown in Table 2 were made for each year, and a summary of the results is given in Table 3.

Table 3.—Average deviation from actual yields of normal yields calculated by various formulæ, expressed in percentages of mean actual yield.

	Formulæ (N = normal yield).	1909	1910	1911	1912	1913	1914
(1)	$\frac{c_1+c_2\cdots c_n}{n}=(c)=N.$	14.3 a(5)	13.7 (5)	9.9	17.5	13.3	17.0
(2)	$\begin{cases} \frac{2}{3}c_1 + \frac{1}{3}c_2 = N \text{ for plat } A, \\ \frac{2}{3}c_2 + \frac{1}{3}c_1 = N \text{ for plat } B, \text{ etc.} \end{cases}$	13.4 (4)	9.9	(5)	13.5 (4)	12.7	15.2 (2)
(3)	$\frac{1}{2}(c + \frac{2}{3}c_1 + \frac{1}{3}c_2) = N$, etc.	11.1	12.5 (4)	(3)	12.2 (2)	8.3	15.3
(4)	$\begin{cases} \frac{1}{2}(c + c_1) = N \text{ for plat } A, \\ \frac{1}{2}(c + c_2) = N \text{ for plat } B, \text{ etc.} \end{cases}$	(3)	10.9	11.0	13.1	10.4	19.4 (5)
(5)	$\frac{p_1 \varepsilon + p_2(\frac{2}{3}c_1 + \frac{1}{3}c_2)}{p_1 + p_2} = N.$	11.8	(3)	9.8	9.9	9.6 (2)	15.1
	$p_1 = 1, p_2 = 3$						

^a The figures in parenthesis indicate the rank in precision of the formulæ for each year.

It is of interest to note that no formula maintained the same relative rank in each of the six years. Some inferences may perhaps be drawn from the fact that No. 5 ranks first 3 times, and No. 1 ranks fifth 4 times. Since there is evidently no way of determining in advance the formula that should be used in any given case to obtain the most accurate results, it would seem that at least for the crop under discussion a very wide margin must be allowed within which variations in yield cannot properly be regarded as significant. The evidence in hand is perhaps insufficient as to the general application of the criticisms which have been made of these formulæ as applied to field work with hops. However, the data upon which the criticisms are founded are sufficiently extensive to afford a basis justifying the suggestion that workers with other crop plants might do well to verify the precision of their formulae before drawing definite conclusions from the results derived from their use.

The lack of precision resulting when the five formulae mentioned in the preceding paragraphs are employed in the manner previously described may be remedied in part by the use of corrected yields and by replication. In order to furnish an example of the use of these methods to increase precision the data from Table I were used in calculating the results discussed below.

Effect on Precision of Correcting for Imperfect Stand.

One of the problems encountered in experimenting with field plots, especially those in which the crop is planted in hills, is how to render comparable the yields from plots which are below normal stand in number of bearing hills or plants. A not uncommon method of correcting is to divide the actual yield of the plot by the number of bearing hills and to multiply the quotient by the number of hills comprising a full stand. The result is the corrected yield. In the case of long rows divided into sections or small plots for distributed grouping, the result obtained when the correction for the row is made plot by plot and the corrected yields combined will be found to differ from that given by the first mentioned method of correction. In order to determine the relative precision of results calculated from corrected and uncorrected yields respectively the actual yields given in Table I were first corrected to correspond to a full stand of 30 hills to the row. Since each row had been divided into 6 plots the yield of these plots was next corrected to correspond to a full stand of 5 hills and the sum of these corrected yields taken as the second corrected row yield. The mean, the standard deviation, and the coefficient of variability for the corrected and uncorrected yields were then determined and are shown in Table 4.

Table 4.—Effect on variability of correcting yields to correspond to full stand.

=				Yield	of rows in	pounds.			
Year.	T.T.	ncorrected vie	alde			Corrected	d yields.		
		ncorrected yi	erus.		Row of 30 hil	ls.	Six plots of 5 hills.		
	Mean.	Standard deviation.	Coef- ficient of variation.	Mean.	Standard deviation.	Coef- ficient of variation.	Mean.	Standard deviation.	Coef- ficient of variation.
1909	169	33.632	19.90	189	29.240 26.874	15.47	188	29.269 25.768	15.56
1911	261	29.274	11.21	280	25.497	9.10	280	26.415	9.43
1912	205	43.988	21.45	247	44.808	18.14	249	42.925	17.23
1913	185	34.934	18.88	198	34.380	17.36	196	35.710	18.21
1914	182	41.875	23.00	231	44.449	19.24	229	47.923	20.92
Aver	age		18.42	4		15.74			15.96

From Table 4 it will be seen that the variability of the yield for individual years with one exception exceeds 10 percent in both corrected and uncorrected yields. The reasons for this variation and for the high value of all the coefficients are not germane to the question under consideration here and will be reserved for future discussion. Inspection of the coefficients of variability will show that those

for the uncorrected yields are consistently higher than those for the corrected yields, although the absolute difference varies from year to year. The coefficients of the two groups of corrected yields differ but slightly in any given year and in only one year, 1914, is the difference as much as I percent. In four cases the yields corrected on the basis of the 5-hill plot gave a higher coefficient than those corrected on the row basis. Since the number of variates in this case was the same, it is permissible directly to combine and average for comparison the coefficients of each group. From these averages it appears that by correcting the yield on the plot basis, the variability is reduced on the average by 2.48 percent, and by correcting on the row basis there is an average reduction in variability of 2.68 percent, as compared with the variability of the uncorrected yields.

Effect of Replication on Reduction of Variability.

Although it is well understood that replication reduces variability, it is desirable to gain an idea of the number of repetitions necessary materially to reduce error in yield of rows of hops, and also to develop a basis for comparing the relative reduction of error in corrected and uncorrected yields which is brought about by repetition. For this purpose the data for 1909 from Table I and the corrected yields for the same year were assembled into series. First the means of the groups of adjacent rows were averaged, and then the average deviation of these means from their averages was determined. This average deviation expressed in percentage of the average yield gives an approximate measure of variation. Next the same deter-

Table 5.—Yields of hops in 1909 (in pounds per row) from 30 rows, arranged in groups to show effect of replication on reduction of variability in yield, and effect on precision of various methods of correcting for imperfect stand.

Correction,	Groups of 5 adjacent rows.		Groups of 5 rows, taking every sixth row.a		rows.	s of 10 taking ird row. ^b	Groups of 15 rows, taking every second row.¢						
	Yield.	Devia- tion.	Yield.	Devia- tion	Yield.	Devia- tion.	Yield.	Devia- tion.					
No correction.	139 188 202 187 149 148	-30 +19 +33 +18 -20 -21	176 164 178 162 162 172	+ 7 - 5 + 9 - 7 - 7 + 3	169 163 175	0 -6 +6	172 165	+3 -3					
Average	169	23.5	169	6.3 3.7	169	4 2.3		3					

TABLE	5	Con	tinu	ied.
A	J.	~	00,000	····

Correction.		ps of 5 at rows.	Groups of 5 rows, taking every sixth row.a		Groups of 10 rows, taking every third row.b		Groups of 15 rows, taking every second row.º	
	Yield.	Devia- tion.	Yield.	Devia- tion.	Yield.	Devia- tion.	Yield.	Devia-
Corrected to full stand, 30 hills to the row.	162 204 219 203 177 171	$ \begin{array}{r} -27 \\ +15 \\ +30 \\ +14 \\ -12 \\ -18 \end{array} $	191 184 200 188 187 188	+ 2 - 5 + I I - I - 2 - I	190 185 194	+1 -4 +5	190 189	0
Average Percentage of deviation	189	19.3	189	3.6	189	3.3	189	0.5
Each of 6 plots in each row corrected to full stand of 5 hills.	160 203 217 205 167 175	-28 +15 +29 +17 -21 -13	189 183 197 184 185	+ I - 5 + 9 - 4 - 3 + 2	187 184 193	-1 -4 +5	190 186	+2 -2
Average Percentage of deviation	188	20.5	188	4 2.I	188	3·3 1·7	188	2 1.0

^a Groups were rows 1, 7, 13, 19, and 25; 2, 8, 14, 20, and 26, etc.

minations were made for various groupings so chosen that the repetitions were 5, 10, and 15 respectively. The results are shown in Table 5.

Inspection of Table 5 shows the greatest variation in the group of adjacent rows with a progressive decrease in variation as the number of repetitions increases. There is also less variation in each of the two series of corrected yields than in the uncorrected yield, indicating in the case under consideration a gain in precision through the use

Table 6.—Summary of effect of replication on reduction of variability in yield of rows and effect on precision of various methods of correcting for imperfect stand, expressed in percentages of deviation from the mean yield.

	Groups of 5 adjacent rows.			Groups of 5 rows taking every sixth row.				ps of 10 every th		Groups of 15 rows taking every second row.		
Year.	No correc- tion.	Row correc- tion.	Plot correc- tion.	No correc- tion.	Row correc- tion.	Plot correc- tion.		Row correc- tion.	Plot correc- tion.		Row correc- tion	Plot correc- tion.
	1											
1909	13.9	10.2	10.9	3.7	1.9	2.1	2.3	1.7	1.7	1.8	0.2	I.O
1910	10.4	9.6	9.3	2.5	2.4.	1.7	1.0	0.9	0.7	0.6	0.5	0
1911	4.9	4.7	5.1	0.3	1.9	2.1	0.2	1.6	1.7	0	I.4	1.2
1912	14.6	13.4	13.1	2.5	2.4	2.2	2.0	2.5	2.6	2.I	2.0	1.4
1913	12.9	12.1	12.2	3.8	3.0	3.4	1.0	1.3	1.3	0.8	0.5	0
1914	14.4	12.7	13.1	3.6	3.2	2.5	2.1	08.	0.8	1.3	2.5	1.5

b Groups were rows 1, 4, 7, 10, 13, etc.; rows 2, 5, 8, etc.

c Groups were rows 1, 3, 5, 7, 9, etc.; and rows 2, 4, 6, 8, 10, etc.

of corrected yields. To obtain more data on this point, the yields for each of the years 1910 to 1914 were assembled in series in like manner as that for 1909. A summary of these computations is shown in Table 6.

These results, with the exception of those for the year 1911, correspond closely with those obtained for the consecutive rows as summarized in Table 4. In the last series the results are less consistent than in the other series, due probably to the fact that there were but two groups in this series. The year 1911 forms an exception to the general rule, due in part perhaps to the fact that the crop in this year was unusually large and the percentage of stand higher than in any of the other years. From Table 6 it is also apparent that five replications materially reduces variability and that ten replications will give a degree of precision such that fairly reliable conclusions may be drawn from a comparison of average yields on groups of treated and untreated plots or rows each containing as many as thirty hills. The effect on precision of correcting to full stand is not constant and does not in every case result in increased precision.

SUMMARY.

In field experiments with hops, including fertilizer tests and variations in cultural methods, a number of the common methods for determining the normal yield of treated plots have been found of little value. Normal yields for various plots varied widely according to the method of computation, the values in some cases differing from the actual yield by as much as 40 percent.

The errors introduced by the use of current methods of calculating normal yield may be remedied in part by correcting for imperfect stand and by replication. However, correcting to full stand does not always result in increased precision.

Replication brings about a very marked reduction in variability, although with only five repetitions the error is still relatively large.



THE SOCIAL OBLIGATIONS OF THE BOTANIST¹

The subject of the address which I am to have the honor of presenting before you this evening was suggested to me on hearing recently a statement to the effect that it is the duty of society to pay for the services of the botanist. It seems to me that there is something to be said on the other side of this question, and, although my predecessors on similar occasions have almost invariably favored you with learned scientific discussions, I shall depart from that ancient and time-honored custom and invite your attention to a consideration of some of the social obligations of the botanist.

A distinguished and honored member of this society has defined botany as that science "that occupies itself with the contemplation of plant as related to plant, and with the whole vegetable kingdom as viewed philosophically—not economically or commercially in its relation to the mineral, on the one hand, and to the animal on the other." From this definition it naturally follows that a true botanist is one who is engaged in research upon plants as such without regard to the relationship they may bear to the welfare and activities of mankind. The history of botany clearly shows that botanists have ever been largely devoted to their science for its own sake, for the pleasure which they might derive from a knowledge of plants. The speculations in which they were absorbed con-

¹ Address of the retiring president before the Botanical Society of Washington, March 3, 1914.

cerned questions of truth and not those of economic values. But throughout the history of the race, the economic aspect of plants has been of fundamental importance to man, since upon them he has ever looked not only as the chief source of the three great necessities, food, clothing and shelter, but also as the means whereby he might cure his bodily ills or otherwise contribute to his comfort and satisfaction. As society became more and more highly organized, there emerged groups of men whose interest centered upon some particular phase of plant utilization which through long-continued study and observation became sufficiently developed to be recognized as an art. The lineal descendants of these groups we recognize to-day in our practical gardeners, horticulturists, foresters, agriculturists and pharmacists. The radical difference in the point of view, between those devoted to botany as a science and those engaged in the practise of its art, ultimately led to the development of a species of class consciousness more than traces of which unfortunately are still in The botanist dazzled by conexistence. tinued contemplation of the aphorism "science for science's sake" became unable to see any science in the practise of the art of botany, and relegated its followers to the limbo of tradesmen along with the smiths, the carpenters and the shoemakers. On the other hand, the groups interested in the practical or industrial aspects of plants

came to look upon the professional botanist as a harmless individual who succeeded very well in entertaining himself, but whose activities were of little if any significance to those whose primary interest in plants was utilitarian.

This class conscious attitude on the part of those who approached the study of plant problems from such widely different points of view led to results of the most profound significance. Botanists in their zeal to preserve their ideal unsullied, and in their fear lest utility should obscure its luster devoted themselves almost exclusively to a dendritic development of their science, the industrial branches of which remained rudimentary if they were not wanting entirely. Until within recent years, the concept of the function and content of the instruction in botany given in our colleges and universities was derived purely from a consideration of the philosophical aspect of botany. In some institutions at least the sentiment prevailed that the courses in botany planned primarily to develop the scientific attitude of mind and habits of thought, had as their chief and legitimate goal the training of students to become teachers of botany. But notwithstanding the increase in the number of institutions of learning, and the consequent multiplication of opportunities for the teacher of this subject to secure a position in which he could maintain himself in a modest way, the possibility of earning a livelihood as a teacher became more and more remote, as an increasingly large number of students graduated and became available as teachers of botany. The inevitable consequence was that many men were turned aside from the pursuit of botany as a profession and entered upon other vocations, which promised to be more remunerative.

But at length there dawned a new conception of botany, one destined not only to modify profoundly the opinion of the public at large with respect to this science, and to revolutionize in many respects the attitude of its exponents in the lecture room and laboratory, but also to pave the way for bringing into sympathetic understanding the workers in widely separated fields of botanical activity. The causes underlying the development of this new conception, which in brief is the recognition of the fact that botany may be utilitarian and still be botany—may be reduced to two, one of which is economic, and the other social.

The economic cause is to be found in the tremendous expansion of technological enterprises which is characteristic of this industrial age. Developments in the field of agriculture have created a demand for men who have been trained to deal with plants in their practical aspects. and industry have recognized the value of the aid which is to be had from science, and have fostered schools for education along technical lines. In response to the demands of technology, many scientific workers have directed their attentions to practical problems, and one result of their combined labors is seen in the change of point of view with respect to botany, and the wider recognition of its utilitarian phases.

The existence of what I have called the social cause, as well as the part which it has played in reshaping the conception of the proper sphere of botany, may not be readily granted, but its absolute denial would certainly impugn the motives of many of the most devoted and conscientious workers in this field of science. This cause had its origin in the fuller realization and clearer perception of the social obligations of botanists. By social obligation is not meant the friendly association with fellowworkers, or the attendance on dinners, and dances, or afternoon receptions, but the obligation of the botanist, as a botanist, to society as a whole.

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So long as botanists were economically independent, or so long as they found it necessary to rely upon some regular profession for a livelihood and devoted only their leisure hours to the acquiring of knowledge regarding plants, they could justly be held accountable only to themselves for the nature and direction of their studies. But as economic development advanced, and division of labor became more pronounced, many people of leisure and culture found it necessary to devote their attention almost exclusively to their business affairs, and the number of professional botanists of independent means became absurdly small in comparison with the number of those who received compensation for their services. For society, recognizing that education along broad and liberal lines was of paramount importance in the upbuilding and perpetuation of our social institutions, has endowed professorial chairs, built commodious structures and supplied the means for securing the extensive equipment necessary for the prosecution of research and the giving of instruction as well as for the support of the teachers and investigators. Thus the economic status of the botanist changed and brought about a corresponding modification in his social obligations, which in turn led to a broader appreciation of the significance of service. Whoever accepts support from another, be that other an individual or society as a whole, does so either upon the basis of charity or upon the condition of giving an equitable return in service rendered. There is no one worthy of the name of botanist who does not scorn the former, and perhaps none who is not satisfied that he is meeting the latter condition. But who is to be the arbiter as to the equitableness or character of the service rendered? botanist? Yes, if he is deeply imbued with a right sense of his obligation to society, but if not, if he is one of those who mis-

take knowledge for an end itself instead of a means to the broadening and energizing of human existence, society will sooner or later relegate him to the place now occupied by the astrologer and the alchemist. Society then has the right to demand, and it is the obligation of the botanist to render service that has a distinct and plainly discernible economic or social value. does not mean that botanists should consider plants only from the industrial point of view, but it does require the abandonment of the dogmatic attitude which has so long been hostile to any union of philosophical interest and industrial needs. It means the obliteration of the class line between the nobility of wild growing plants and the bourgeoisie of cultivated species; it means the recognition and acknowledgment by teachers and investigators that very practical and commonplace subjects, such, for example, as the germination of ordinary garden seeds, often present as profound theoretical problems as those which are far removed from the field of possible utility; it means the recognition of the principle aptly stated by a recent writer in another connection that "It is the interaction of various types of human thought and investigation, and not mutual isolation or contempt, which helps us all, while he does best who works with the profoundest theoretical problems and the most intensely practical interests at once pressing upon him, with the widest and most philosophical breadth of view, and the most faithful special labor, at once demanding attention."2

The socialization of industry and the specialization of almost every line of human endeavor has necessitated fundamental changes in the spirit and methods of education. No longer is the hope held out that more than a fraction of the students that fill our schools and colleges can win a com² Royce, J., Science, N. S., Vol. 38, 1913, p. 584.

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petence in the learned professions, and large numbers must be encouraged to look for their life work in some line of activity closely associated with industry. To such of these as may choose an occupation in which practical knowledge concerning plants will be of benefit, the social obligation of the botanist is clear. He should encourage rather than discountenance investigations of a very practical nature, relying upon his own endowment with the true scientific spirit to so shape and direct the work of his students that it may lead to the development of the desired scientific attitude of mind toward the fundamental principles of plant life. To be sure it will be objected that in such a course lies the danger that education will become a merchandise and science be degraded into a mere trade. It is feared that the time spent in learning anything which can not be turned into money will come to be considered as lost and that no longer will there be any interest in the search for truth that does not bear the earmark of utility. seems to me, if there is any danger to the future of botanical science, that it lies in an entirely different direction, that is, in the failure to recognize the great possibilities for the development and stimulation of widespread interest in the more theoretical aspects of this subject, growing out of its relation to the material affairs of men in general, for just as our social workers have learned that religion offers poor comfort to the man whose stomach is empty, and whose body is imperfectly clothed, so botanists must come to see that their philosophy will mean little or nothing to the great mass of society unless it finds some expression along lines of human interest and necessity.

It is a social obligation of the botanist to insist that the standards by which he is to be judged shall be those of personal. value rather than the standards of wealth.

Measured by the latter, his position in the economic scale may be regarded as comparable with that of the wage-earner or his fellow worker in the trades, whose usefulness to society is largely measured by his ability to adapt himself to the material and often mechanical requirements under which he must perform his task. The usefulness of the botanist, however, can not be so measured, for the service which he renders to society is of an order entirely different from that of the craftsman. His work is to explore the boundaries of knowledge in his search for additional truth, to break the bonds of tradition and opinion when they fetter progress in the solution of scientific problems, and through creative thought to advance the science of botany and its useful applications. The value of his service is not necessarily conditioned by his salary, his degrees, his hours of work or the number of his printed pages, but it does depend, in part at least, upon his open-mindedness to truth, upon his ability to direct his efforts along productive lines, upon the validity of the conclusions based upon his researches, upon the contribution which his discoveries make to social welfare, and upon his power to inspire and right to retain public confidence in the value of botanical investigations. Through his deep sense of community of interest and the recognition that his studies may be of service to all mankind, he thus places himself beyond the pale of economic class distinctions, and is entitled to be judged solely by his personal value.

Nevertheless, botanists themselves have a tendency to judge each other by standards which fall far short of those of personal value. Too often is the sign accepted at par value when the thing signified is only debased currency. An array of scholastic degrees and a long list of titles of published articles may gain for the fortunate possessor a recognition wholly dis-

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proportionate to the service he is rendering either to science or to society. The muchdeplored tendency to "rush into print" on slight provocation or on no provocation at all, and the frequent occurrence of the legend "Read by title" in the proceedings of our societies and associations, is at least presumptive evidence that judicious advertising is not without its reward to the individual irrespective of any other results that may follow. The objection which may here be made, that men who are widely separated can come to know each other's work only through their respective publications, answers itself, for the argument is entirely against setting up as standards of measurement, degrees, instead of the personal value to society of the man bearing the degree, and against regarding titles of publications rather than the merits of the publications themselves.

When scientific men overestimate the importance of its symbols to the neglect of achievement itself they give hostages into the hands of those who seem to think that scientific activity can be measured according to some fixed standard, and its value expressed in numerical terms. They also limit and restrict their usefulness to society when too much account is taken of those personal distinctions which are often made between workers in different lines of scientific activity and sometimes between those in lines which are closely related. It is . necessary to emphasize the standard of personal value and to insist that a clear distinction be made between the nature of the task of the scientist and that of the industrial worker if the former is to remain free from checks and hindrances which are incompatible with true scientific progress, and if he is to be awarded recognition on the basis of his real contribution to the progress of civilization.

It is a social obligation of the botanist to be a man of affairs. The outlook for the future is that the bond between scientific investigation in botany and economic work will become closer and stronger, and that botany, already occupying an important place in the applied sciences and in human affairs, will gain even wider recognition as one of the permanent forces underlying social progress and activity. will bring greater and more insistent demands for the extension of inquiry into every field where the application of the fundamental laws and principles developed through the scientific study of botany promises to minister to the needs of humanity. The organization and direction of the botanical work of the immediate future, in a manner that will preserve the proper balance and correlation between scientific research of the broadest and most fundamental character, and investigations undertaken largely or entirely for economic ends can be successfully accomplished by men who are not only broadly trained botanists, but who are men of affairs, as well.

Scientific progress is not accomplished by the mere accumulation of knowledge, but follows only when knowledge is communicated and brought within the grasp of all who are able to utilize it in any phase of human endeavor. The rapidity with which new knowledge makes its way and the extent to which it finds ready acceptance and assimilation depends upon the terms in which it is formulated, upon the clearness and thoroughness with which its relationship to other forms of knowledge is presented, and upon the number and variety of its possible applications which may be pointed out. Manifestly, he who will succeed best not only in securing the fullest appreciation and utilization of the results of his work, but also in obtaining merited personal recognition for his services, is he who retains a broad and liberal point of view with respect to the related branches of his science, and who is able to

put himself into sympathetic relations with men who differ widely in interest and activity.

The scientific worker who would remain in the most active lines of modern progress, and who appreciates the disappointments and discouragements that often fall to the lot of one who has failed to keep in sympathetic relations with the spirit and purpose of the age in which he lives, will find it desirable not only to acquaint himself with developments in lines of scientific investigation widely separated from his own, but also to extend the scope of his mental horizon until he can obtain a clear view of the readjustments and changes which are constantly taking place in the domains of industry and education and in the fields of political and social affairs. The idea here expressed may be regarded as wholly fatuous and incapable of realization, but the fact remains that specialization alone will lead to a dendritic or treelike development of science, which instead of conducing to general progress, will ultimately operate as a hindrance to it. deed, the development of a science is in many respects analogous to the evolution of a species of organisms, for just as the latter make evolutionary progress (I here quote a well-known writer on organic evolution) only through being "connected with each other by an intricate network of descent in the weaving of which the diversities of the members of a species have a definite physiological value," so will a science approximate the maximum limit to its capacity for progress only through the continuous interaction of the ideas and the integration of the principles developed in its various phases and aspects.

It is a social obligation of the botanist to study processes, to penetrate more deeply into the mighty forces of organic nature to the end that they may be brought more completely under the control and direction of man. The satisfaction of human wants is in a large degree dependent upon processes which have been slowly built up by plants through countless ages of gradual development, and since the laws governing them are not sufficiently well understood, these processes have played a small part in the advancement of industry. We have no choice, for the most part, but to accept such products as the plant may yield, instead of being able either to fully control its activities, or having discovered the secret of its processes, to utilize them in the direct production of desired mate-The problems here involved are fundamental in character and can be solved only by scientific research of the highest order. It is not a question of applied science, but a search for the underlying principles which may lead to a full understanding of the functioning of plants, and the scientific worker who achieves success in this field will not only make a noteworthy contribution to science itself, but will also make possible profound and advantageous changes in the world of industrial affairs.

No less important than the investigation of the processes of plants themselves is the study of the processes by which they have come to be what they are. In this lies one of the most fundamental problems of modern botany, a problem which involves no less than the ultimate elucidation of the laws which have determined the evolution of the vegetable kingdom. The successful solution of this problem promises results of profound significance, and advanced workers in this line of botanical activity have predicted that the time is almost at hand when our present system of classifying plants will be supplanted through "the discovery of a system which shall depict plants in their evolutionary sequence."

The botany of the future will be more

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and more concerned with a study of the very recent stages in the descent of the living flora, and there can be no doubt that this line of research will be greatly stimulated by economic considerations. efforts to bring under control those processes by means of which improved species or varieties may be originated, will lead to a much wider study of plants, and to a critical study of their relatives from widely separated situations. In arboretums and botanic gardens as well as in the great herbariums there will be brought together collections of materials for use in the investigation of genetic relationships. the future, it is not too much to hope or expect that in proportion as our knowledge of these relationships increases corresponding advances will be made toward a solution of some of the complex problems of evolution and heredity.

It is a social obligation of the botanist to be efficient. Stein³ in his brilliant work on the philosophy of society observes that "The sense of obligation can never be derived from biology." It would seem to be self-evident that the complex facts of human life and experience can not be rightly interpreted by the same natural laws which govern the growth and development of a biological organism, although the latter view has not been without its exponents and followers. But public opinion, though long suffering, can not be depended upon to forever countenance those scientific workers whose attitude toward society is expressed by the old doctrine, "mind your own business," and whose rule of conduct recognizes no influence or appeal that lies beyond the limits of their science. service of highest efficiency, however, will be rendered by those who through experiment, observation and generalization, succeed in dispelling the mists of shadowy

³ Stein, "Die soziale Frage im Lichte der Philosophie," 1897, s. 222.

suggestion which have prevented a clear view of many facts of nature, and who at the same time prepare the way for their widest application and utilization.

The efficiency of the scientific worker bears a very direct relation to the motives which guide him in his work. The temptation to follow the line of thought or study that for the time appears most attractive is very great and for some irresistible, and advance in one direction proceeds only until a new and more inviting path is crossed, but the scientist who pursues such a wavering course is apt to be like the aeronaut, very much in the air. The most effective workers are those who have the greatest power of sticking to a subject until every means of forcing the truth to reveal itself has been exhausted. As the necessity increases for a general attack upon the more difficult and fundamental problems, the greater is the demand for patience and perserverance in the prosecution of investigation. The homely, but expressive saying, "It's dogged as does it," which was often quoted by Darwin, illustrates a mental characteristic which has led many a man to overcome apparently insurmountable difficulties.

It is also easy to fall into the error of assuming that the collection of data is science and that whoever actively and industriously accumulates a large collection of observations on various natural phenomena thereby contributes largely to scientific progress. But the application of thought in lines that lead to definite and tangible results, and the collection of data to some useful purpose, "will always have as their guiding motive the testing of some tentative hypothesis needed for the explanation of our experience." The shelves of our libraries bear many a musty tome in which are recorded countless observations on the phenomena presented by plants, but many of these observations have little mean-

ing for science to-day either because they were not made with sufficient discriminating care and precision to give them scientific accuracy, or because they lacked the correlation with well established facts necessary to their interpretation in harmony with later discoveries. Other observations have remained in oblivion or conscious neglect, either because of the accident of their place of publication or because they did not appear in one of the "recognized" mediums of scientific utterance. It seems reasonable to assume that the scientific accuracy or validity of published observations or conclusions depends upon the efficiency of their author rather than upon the place of publication. Those who regard a restricted group of books and journals as a canon to which alone they look for authentic scientific utterance, and regard all others as apochryphal do but perpetuate the ancient schism between the botanists, on the one hand, and the gardeners and horticulturists on the other.

Efficiency implies not only a wide knowledge of facts, but also a breadth of view which will enable the relations between various categories of facts to be seen clearly. How the lack of understanding of the known phenomena and facts may operate to retard the diffusion of knowledge is well illustrated by the failure of contemporary scientists to understand and accept the discoveries of the early plant breeders. While the gardeners were making discoveries the importance of which was not recognized until nearly a century later, the real scientists were occupied with the recognition and classification of species. The failure of botanists to give credence to the early investigations in plant breeding has been variously explained, but we may well accept the view of Focke4 that "these discoveries did not fit into the idea of nature then

⁴ Focke, W. O., "Die Pflanzen-Mischlinge," 1881, s. 433.

current, for they could not be reconciled with the known facts and therefore were disregarded."

The obligation to be efficient in the avoidance of error is by no means to be taken lightly. The young writer who excused his carelessness of statement and inaccuracy of citation by saying "everybody makes mistakes" no doubt uttered a truism, but he also displayed his profound ignorance of the difficulty with which a misstatement is rectified when once it has gained a footing in literature. There is perhaps no more striking example of the strange fabric that may be woven with the warp of truth and the weft of oversight or error, than the biological principle known as Von Baer's law.

Von Baer is renowned as the originator of the theory that the embryo of every higher animal during its development passes through successive stages in which it simulates the adult forms of the lower animals in the same phylogenetic series. But Von Baer did not originate this theory, indeed he was its most vigorous opponent. What he really taught was that the embryos of different animals are similar to each other in that they adhere to the same plan of development, but through the failure of some of his contemporaries to be precise and discriminating, the ideas of another man were mistaken for those of Von Baer, and the latter was thereby placed in a false light in respect to the contribution which he made to science.

Manifestly a high degree of efficiency is just as desirable in interpreting and citing the writings of other workers, as it is necessary in planning and successfully conducting the work of experimentation, and the scientific worker who renders the best service both to himself and to his science will be as zealous in avoiding the perpetuation of error as he is ardent in his search for truth.

It is a social obligation of the botanist to strive for a better organization of his science. It is not my intention to raise that much-discussed question "What is botany?" the answers to which are approximately as numerous as those who are or who think themselves botanists, although I deprecate the contrariety of opinion which exists with respect to what may properly be included in the domain of this science. Some maintain the old distinction between pure and applied science, and would exclude from the science of botany such subjects as plant breeding, economic botany and plant pathology; others think botany is largely an applied science, consisting in part of mere applications of other sciences; some conceive the science as largely restricted to one of its phases, as, taxonomy, morphology or physiology; and still others maintain that botany is not a single science but a group of distinct sciences with nothing in common except the fact that they are concerned with the phenomena presented by plants.

Segregation and specialization in various lines of botanical activity seem to be a natural process necessarily attendant upon scientific progress. Competition between these lines, each of which seeks to gain the ascendency, and to become recognized as the true representative of the science, also seems not only natural, but necessary to normal and progressive development. There exists, however, a sufficiently close analogy between the evolution of a science and certain phases of organic development to justify the consideration of a well-established biological principle in discussions of the relative importance of different branches of the science, or the promise which they hold out of contributing most to its advancement. This principle states that "the point of departure of the progressive lines of one period of time has not been from the terminal types of the lines of preceding ages, but from points farther back in the series." The evidence is not wanting that the new and progressive lines of botanical activity do not originate directly from the most highly specialized branches of the science, but from the more unspecialized portion. Thus arose ecology, pathology and genetics, and so doubtless will the future see the origin and development of other important and vigorous branches of this science.

It seems inevitable that from time to time each branch of the science will pass through eras of reconstruction unless, indeed, "it is assumed that the existing order is a closed system within which men can and should rationalize their conclusions. but only within that system and ever under its authority." But such a philosophy is incompatible with the modern spirit of progress, which is constantly utilizing accumulated experience in the development of new points of view and demanding a frequent readjustment of the relations existing between allied lines of investigation. The organization of the science, however, implies much more than the harmonious adjustment of relations between its various branches, or agreement as to their proper sphere of activity. It requires that botanists realize that their duties are not fulfilled by investigation alone, but that there is also incumbent upon them the obligation to give serious consideration to what for want of a better term may be called the business affairs of the science. If the great body of investigational work now in progress is to have continued growth and opportunity for unrestricted expansion, the means must be forthcoming to provide for its support, and to assure the protection of its interests. Society must be looked to as the source of these means, and how freely they are given and what restrictions or limitations are imposed with respect to the manner in which they are to be applied

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will depend largely upon the degree to which there is developed in the public at large a sympathetic appreciation of the aim and purpose of the science of botany.

It is relatively easy to obtain financial support for a scientific enterprise which promises speedy returns in kind, but when the energy expended in such an enterprise is devoted solely to securing showy and immediately practical results, then does scientific education become a mere matter of merchandise and science itself is degraded to the level of a trade. Public support to scientific enterprise must be secured on some other basis than that of annual dividends. Results of great and permanent benefit to society may rightfully be expected, but they must be looked for in the better understanding of the forces of nature and their application to the promotion of human welfare, in the development of constructive habits of thought, which tends to forecast the future by an analysis of the facts of the present, and in the social progress which will be favored by a clearer perception of the relations existing between plants and man.

It is fruitless merely to affirm that more attention should be given to the claims of science, or to condemn the non-scientific classes for estimating the importance of scientific work according to its money value. I am persuaded that the muchdeplored tendency to look for immediate and practical returns from scientific work is due less to crass and sordid motives than to a lack of right understanding of the manifold ways in which science exerts a beneficent influence upon the affairs of men. This disability, however, is not beyond remedy, and will be much less in evidence when greater attention is given to the education of the individual along lines which will lead to a better perception of the real meaning of science. Organization and

unity of spirit and purpose directed to the scientific education of the public are essential if practical men are to be brought to see that their interests will be furthered by encouraging scientific work and if society is to be depended upon for its liberal support.

Finally, it is an obligation of the botanist to recognize the beneficent influence of personal association. inspiration The gained by participation in the annual meetings of our scientific societies and associations is too well appreciated to need elaboration or comment. Similarly, the importance of the close personal relation between the student beginning research and his instructor is clearly understood. But it is of the possibilities which lie in the closer personal association between the junior and the senior members of this society that I would speak. It is sometimes said that the younger generation is inclined to be dogmatic, self-sufficient and somewhat disregardful of the wisdom and knowledge acquired by their elders. If this be true, it is largely because the printed page has been substituted for the more natural means of communication between individuals. But the printed page transmits very imperfectly the intangible something we call personality, that power to kindle in others the fire of enthusiasm, to develop that point of view which leads to creative thinking, and to point the path to that insight and vision which has been attained by those of riper wisdom. The younger generation needs the personal inspiration and guidance which it is within the power of their elders to give, nay, more, they stand alert and expectant awaiting the time when their natural leaders may signify their willingness to give them counsel and instruction. When the senior members of this society raise the banner of wisdom and experience, and sound the assembly call, they will find their juniors quick to desert the paths which, like those in a woods, end nowhere, or which lead over the heights of purely intellectual gratification, or through the picturesque valleys of individualism, and, rallying to their standard, be content to march together along the broad road of cooperation, and united effort, which ultimately leads to the heights of progress. And then when our leaders shall approach

the end of life's journey, they will have the satisfaction of knowing that although their printed works may soon be superseded or sink into oblivion, the influence of their inspiration and personality, perpetuated through their friends and fellowworkers, will endure for all time.

W. W. STOCKBERGER

U. S. DEPARTMENT OF AGRICULTURE



UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
Office of Drug, Poisonous and Oil Plant Investigations.

SUNFLOWER

U. S. Department of Agranulate

★ JAN 24 1908 ★

The sunflower has been cultivated to some extent in almost all parts of the United States either as an ornamental plant, for its seed, or as a silage crop.

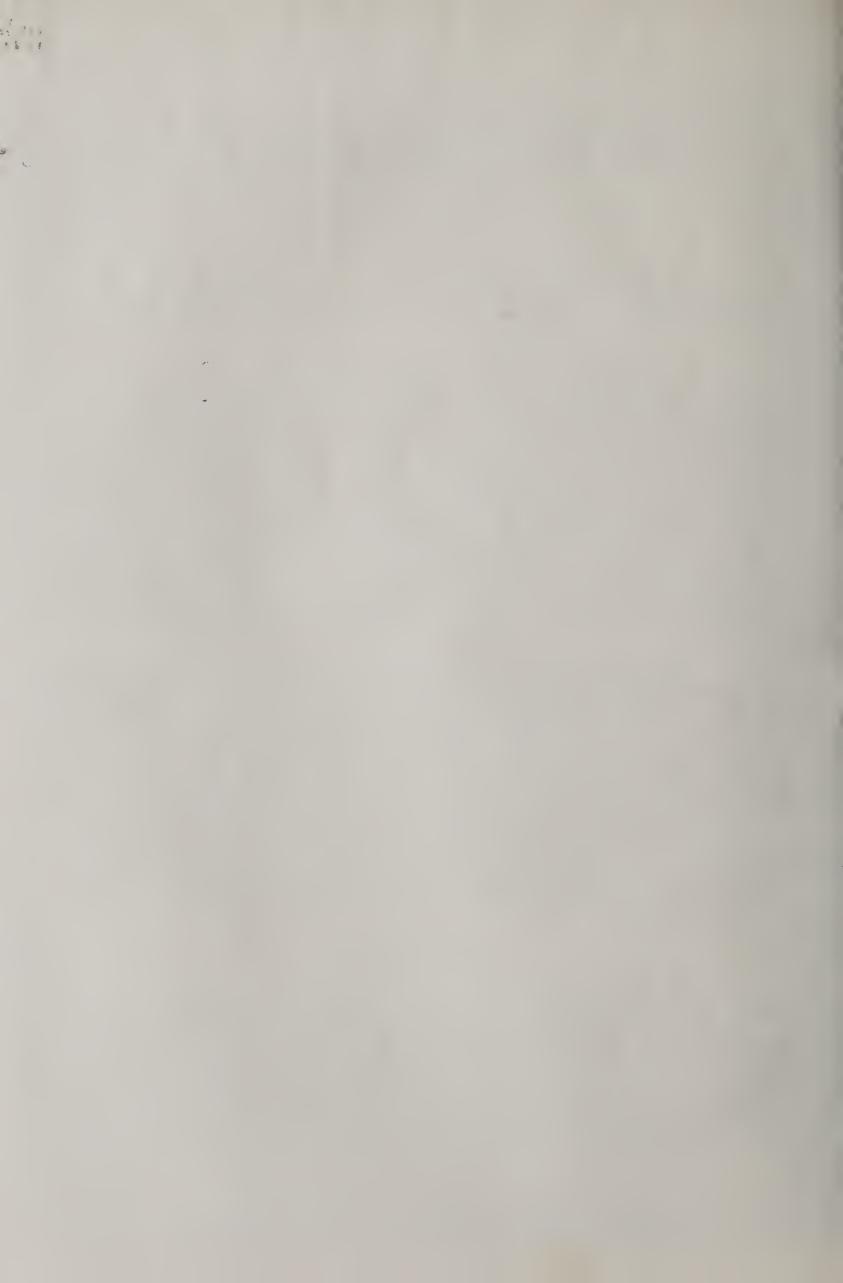
The Sunflower as a Seed Crop

The sunflower has been grown as a seed crop chiefly in California, Illinois, Indiana and Missouri. When cultivated for this purpose it does well wherever the soil and climatic conditions are favorable for the production of good crops of corn. Land to be planted to sunflowers is prepared as it would be for planting to corn. Sunflower seeds may be safely planted somewhat earlier than corn, as late spring frosts do not kill the young plants. However, where the season is fairly long, they may be planted on lands which have remained too wet for cultivation until 2 or 3 weeks after the season for planting corn is past. The seeds may be planted by hand or with a corn planter, about 2 inches deep, in hills 3 feet apart in rows 3 or 3-1/2 feet apart. From 4 to 8 pounds of seed are required to an acre. The Mammoth Russian variety is preferred for seed production. When the plants are 8 to 10 inches tall they are thinned, leaving two to each hill. The crop is cultivated in practically the same manner as corn.

Sunflowers grown for seed are generally harvested just before the seeds are quite ripe enough to shatter, usually about the middle of September. Various methods of harvesting and thrashing are employed. Frequently a wagon with a tight box fitted with one high side-board is drawn alongside the rows, the heads are cut off with a stout, sharp knife, and thrown into the wagon box and against the side-board, whereby a large part of the seed is shelled out. A workman in the wagon uses a stout stick or curry-comb to remove any seed remaining in the head, which is then thrown upon the ground. In this manner three men usually harvest and thrash at least one-acre a day. Sometimes a pea or small grain thrasher is used to separate the seeds from the heads. Except with very small crops, the use of a machine will effect a large saving of time and labor in thrashing. The seed is cleaned on a fanning mill, spread out on a floor, and turned at intervals until thoroughly dry, since new seed tends to become musty if stored in large quantities.

Yield and Prices.

The yield of seed is quite variable and depends largely upon the nature of the soil and the character of the season. Under very favorable conditions the yield may reach 2,000 pounds per acre, but usually ranges from 800 to 1,200 pounds per acre. The weight per bushel of seed varies from 25 to 35 pounds, averaging about 30 pounds. Prior to the war the estimated cost of producing sunflowers in this country was nine to twelve dollars per acre. The price for the seed paid to growers ranged from \$2.00 to \$4.00 per 100 pounds. On a basis of a yield of 1,000 pounds per acre and a price of \$3.00 per 100 pounds, the net return to the grover was not far from \$20.00 per acre. During the war years the



price was greatly increased, but has since declined to about prewar figures. On November 12, 1921, the average price paid to growers in Missouri and Illinois was \$2.75 per 100 pounds, and to growers in California \$4.25 to \$4.75.

Uses of Sunflower Seed.

Sunflower seeds are extensively used as feed for poultry and birds, and are often fed to farm animals to improve their physical condition. The seeds are rich in fat and protein, and it is usually preferred to mix them with other grains in feeding. Under pressure sunflower seeds yield about 20 per cent of oil, the higher grades of which are edible. The poorer grades are useful in soap-making, wool-dressing, in paints and in certain kinds of varnish. The cake left after the extraction of the oil by pressure has a feeding value approximately equal to that of the cake resulting from the expression of corn oil or linseed oil. It is doubtful whether sunflower oil could now be manufactured at a profit, owing to the present high price of the seed and the relatively low prices of other oils with which it would come into competition.

The Sunflower as a Silage Crop.

Experiments with sunflowers as a silage crop have been carried on for several years in a number of states, for the most part with gratifying results. The variety generally grown is the Mammoth Russian, seed of which may be obtained from local dealers or the larger seed houses. The viability of the seed should be tested before sowing. Under ordinary conditions when planted along, the seed is sown at the rate of 8 to 10 pounds per acre, under irrigation 12 to 15 pounds, and when mixed with corn about 4 pounds. The seed may be sown with a grain drill set to space the rows the same as for corn. When well up the plants are thinned to stand 6 to 8 inches apart in the row, or 12 inches apart if under irrigation.

Sunflowers for silage are cultivated like fodder corn and at about the same expense. They are cut when a little more than one-half the seed is in the milk stage. In harvesting, the corn binder is used, but many crops are cut by hand. The plants are run through an ordinary ensilage cutter and siloed like corn.

Yields of green forage reported have ranged from 5 to 10 tons per acre under dry-land conditions, and from 20 to 30 tons per acre where sufficient moisture was available. These yields range from 50 to 200 per cent greater than that of corn grown under similar conditions.

Under conditions of soil and climate especially favorable for the growing of corn, sunflowers make a rank growth, are hard to handle and frequently offer no advantage over corn for silage. Sunflowers promise to become a useful silage crop on soils not entirely adapted to corn, and in regions where the growing season is too cool for the production of large yields of silage corn. The crop is more resistant to drought than corn, and has given yields 60 per cent greater than corn under the same severe drought conditions. It is also much more resistant to frost than corn, and usually remains green from 2 to 3 weeks after corn has been cut by frost.



Preliminary tests with sunflower silage indicate that its feeding value is about the same as that of corn silage. Sunflowers when cut, dried and fed as stover are also said to show a good feeding value.

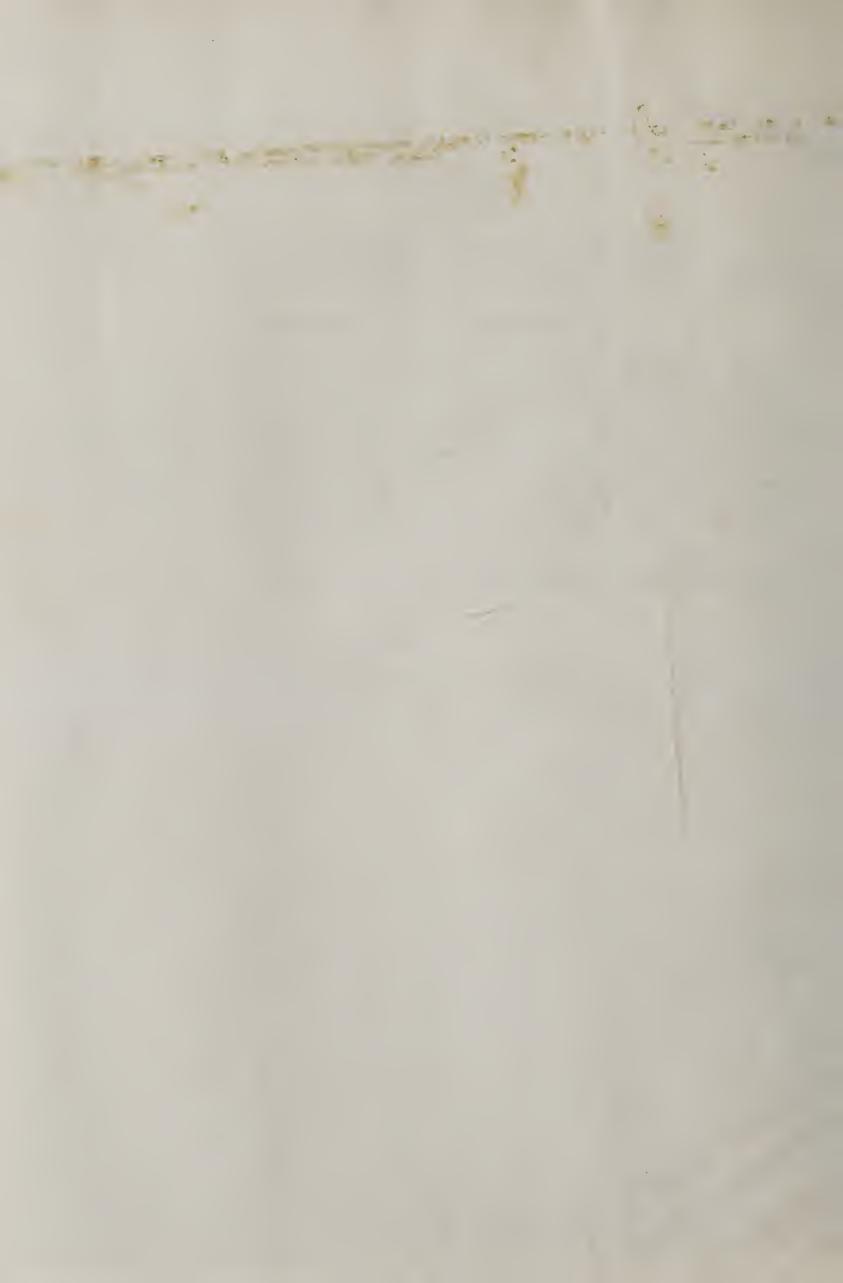
Diseases and Pests of the Sunflower.

The sunflower plant is more or less subject to the attacks of several plant diseases and insect pests. One of these is a rust which has caused very serious damage in some sections, especially where the crop has been grown for several seasons in succession. The sunflower weevil frequently attacks the sunflower seed before it has ripened sufficiently to be harvested, and in some sections of the United States where sunflowers have been grown for several years in succession the rayages of this pest have caused the crop to be abandoned. Systematic rotation of the sunflower with other crops has been recommended in weevil-infested areas. In some places cut-worms have proved troublesome, and in others grasshoppers have destroyed the entire crop.

Sunflower heads, when they are ripening, are very attractive to birds, whose depredations frequently cause heavy losses of seed.

W. W. Stockberger

Physiologist in Charge of Drug, Poisonous and Oil Plant Investigations.



Vanilla Beans in the United States*

By W. W. STOCKBERGER, Physiologist

Bureau of Plant Industry, U. S. Department of Agriculture

Mr. Chairman and gentlemen: Your secretary kindly and thoughtfully placed in my hands a few moments ago these records of the minutes of the previous meeting, and although he made no suggestion about it, on turning through the pages I find a rather elaborate report of previous discussions on vanilla. I appreciate his kindness, but nevertheless what few remarks I have to make upon the subject of vanilla will be, I assure you, on somewhat different lines from those contained in the minutes of the previous meeting. (Applause and laughter.)

utes of the previous meeting. (Applause and laughter.)

Briefly, what I want to tell you is this: About fourteen years ago, in Florida, the Bureau of Plant Industry opened an experimental garden at Miami, into which were brought plants from various tropical countries with the idea of determining whether or not they might be acclimatized, or perhaps some of them adapted for cultivation in that section which is below the frost line. Professor Rolfs, who



is now the director of the Agriculture Experiment Station in Florida, visited Mexico, passing through Vera Cruz, and from there, among many other things, he sent back a collection of cuttings of the vanilla, which is grown in that section. Six years later another of our men visited the West Indies and the Bahamas, and secured additional collections of cuttings of vanilla. These were brought back to Miami and there planted. To-day there are about fourteen different varieties of vanilla growing in the gardens at Miami. These plants have not been watched carefully or cared for as considerately as many other plants which we have introduced, hoping to secure an early and perhaps favorable introduction in the market, but they have

*An address made at the third annual meeting of the Flavoring Extract Manufacturers' Association, Baltimore, Md., June 4-6, 1912.

been taken care of in a general way. A sort of lattice or trellis or shade was erected of timbers covered with lath work under which these vanilla plants were cultivated, and where they are now growing. No particular attention has been given, as I said, towards determining the requirements in the way of soil or special method of handling. They have been given the ordinary garden treatment. To my knowledge no variation has been made in the shade since it was first erected. Whether we have too much shade or too little is naturally a subject for experiment.

These plants come into blossom usually in April or in May, varying somewhat with the season. There are usually a number of blossoms, and in January or February of the succeeding year a number of pods usually mature. I have here a photograph of natural size, showing a cluster of pods of the Vanilla Planifolia, Andrews, which represents the typical plant and the pods as they are

produced in these gardens.

The curing of these beans I attempted since it was necessary that something be done with them or they would spoil. I did the best I could, and very hastily, to see whether they could be cured and something made out of them. The results of some of these endeavors I have here and will now show you. In deference to this being an official experiment and contrary I think to the usual trade custom, these samples are bound with red tape (laughter).

Mr. McCormick and Dr. Baer have seen these in my laboratory, and also a sample which I have not with me, a few pods that I placed in a glass jar upon which a few crystals of vanillin had developed. Gentlemen, I would like to have you look at these. That is home-

grown vanilla.

(Bunches of cured vanilla beans were here passed among the members of the association.)



Mr. Clawson: How long did it take you to cure this?
Dr. Stockberger: Well, I want to tell you the story about that if it will not bore you. I began by trying some of the common methods of curing; first by dipping the beans into hot water and then wrapping them in cloths and keeping them warm, and allowing them to go through the usual process of fermentation. In the case of that treatment I suppose three weeks, perhaps elapsed before they were sufficiently dry so they could be laid aside in a drawer. Others of these beans were simply put into an ordinary laboratory oven after they had begun to turn brown, and kept warm, at a moderate temperature, and allowed to become dry. I do not know exactly the time, but they became dry in the course of a very few days. Another bunch of them I simply wrapped in a towel and threw into a covered glass jar to prevent too rapid drying. They were allowed to remain there until they were dry. Some of them I simply threw down on the laboratory table, where they were allowed to stay for a matter of two or three weeks, receiving absolutely no attention whatsoever, and these samples before you now have received that kind of treatment. The elaborate method of curing, the sweating process, so far as I could determine, produced no better results than in the case of those that were simply thrown down on the laboratory table and allowed to go through the natural process of curing, or in the case of those that were allowed to cure in the oven. I think one of these bunches shows it was cured too hastily. That was the one that was dipped in hot water before it had sufficiently browned. This is of very little interest perhaps, except in connection with one point. The beans, or the portions of beans which are in this glass vial were taken from fresh material

received in the laboratory before any sign even of yellowing had occurred. The beans were still green in color. They were placed immediately into absolute alcohol, which of course was slightly reduced by the sap. I think probably the material had stood in the sealed jar in this solution with practically no air over the top for a year, before any investigation of the material was made. Then an examination of the liquid was made to determine if possible the glucosides. I was anxious to see the results. While this has not yet been subjected to as thorough and rigid an examination as I desire, no glucoside has turned up, but an abundant deposit of crystals of vanillin has been secured.

If vanillin can be developed in these beans in absolute alcohol I do not quite see why it is necessary to go through all this laborious and rather uncleanly method of preparation to which many of the beans are subjected, and if vanillin can be produced in the beans through the methods which I have used in very crudely curing these beans I believe that improved methods for curing beans may be worked out which would entirely eliminate many of those undesirable practices, and which might, perhaps, put the curing of beans on a thoroughly scientific basis, one which would be acceptable from the standpoint of cleanliness, and one also which would involve much less labor, and be more adapted to conditions

of commercial production in this country.

I know you will find this material exceedingly rough. It has split; and darkened and discolored, and it is wrinkled, and probably never would be accepted by the trade except under certain conditions, but the thing which I am anxious to know, and will say in closing is this: Department has shown that the vanilla plant will grow and fruit in the United States, and if suitable areas for the introduction of the culture of this plant exist in Florida I believe that with proper commercial help, the culture of vanilla beans in the southern part of the United States might possibly be introduced on a commercial scale. And, as I said, we have now shown that the plant can be raised; at least, it has stood those conditions of cultivation for fourteen years; that it is possible to produce the beans in the vicinity of Miami, and that under expert landling probably a fair quality of product could be produced. If the quality exists, and if the trade would accept this material, I believe that the proper sort of encouragement might help to demonstrate the commercial produc-tion of vanilla in the United States. At the present time it is purely an experiment, and has been carried on in a very limited way, we might say, for a number of years, but has reached results which I present to you this after-I thank you for your patience. (Applause.)

The President: Doctor, I would like to ask you if you have ever made an alcohol extract of the vanilla beans you have grown? In other words, made an extract of vanilla

from those beans?

Dr. Stockberger: No, that I have not done. I am not a chemist. When it comes to extracts that is in the domain of Brother Chace. I will say, however, that extracts have been made with various menstruums, and apparently satisfactory flavors have been developed.

Mr. Clawson: Did you ever try the flavoring extract that

you made from the bean, try to use it to see what the

flavor was?

Dr. Stockberger: I have not done anything like that at all. My extracts were used only for analytical purposes.

Mr. Clawson: That is the most interesting thing I have

seen in connection with vanilla beans.

Dr. Stockberger: It is to me. On theoretical grounds I did not expect to find any vanillin, but I am absolutely positive of the whole manipulation because I did it myself. I know that the beans were green, every one of them, absolutely green in color, and the alcohol was practically one hundred per cent, and there is the result. What that could be used for I do not know, but I simply present it to you as a suggestion. If it is entitled to any further consideration by you I should be glad to know it.

Dr. Baer: From the practical consideration, as I under-

stand it, the government would be willing to go ahead with further experimentation if there were any reason to believe it would be taken up later by the commercial

interests.

Dr. Stockberger: We feel like this, doctor: We feel that there is a reasonable certainty of this material being taken by the trade, and if we can tentatively figure out per pound the price at which it would be taken we could count costs, as it were and so determine the practicability of further experiments. If it is going to cost us twentyfive dollars per pound to produce vanilla beans in southern Florida we will not go any further.

Dr. Baer: Have you any idea what it will cost?

Dr. Stockberger: No, I have not yet entered into that except in a general way. I believe if we could get a fair

price—I say that advisedly—a fair price per pound, that it might be possible to produce vanilla with a margin of

profit.

Dr. Baer: I believe every extract manufacturer would be more than pleased if they could grow the beans in this country under scientific methods of curing, but could you quote any figures that you would be willing to submit to us on the question of cost? Perhaps a number of manufacturers would guarantee to take so much of it at a certain price. You do not know how many beans they would grow per acre.

Dr. Stockberger: I am absolutely in the dark on that. The President: Would not the best way be to make a formal request backed by this association that the Department of Agriculture place in the hands of a committee appointed by this association some green beans and some cured beans for experimental purposes. I believe the Department of Agriculture would be very glad and willing to go that far and then upon the report of that committee the association as a whole may take it up. I make that in the form of a motion—that the secretary write a letter to the Department asking that they place at the disposal of a committee appointed by the chair, green beans and also cured beans for the purposes of experimentation.

(Upon motion duly made, seconded and carried, it was resolved that a letter be written by the secretary to the Department of Agriculture, that they place at the disposal of a committee to be appointed by the president, green beans and also cured beans for the purposes of experi-

mentation.)

The President: Doctor, we thank you very much. That is one of the most interesting subjects we have had brought before us. The next on the program is an address on the legal standard for flavoring extracts and a commissioner's experience therewith, but Dr. Caspari has asked that he be called last. We have with us our genial friend, Mr. Gardiner, who makes ice cream, and he has kindly offered to say a few words on that subject.

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OR THE ATE By direction of the Secretary of Agriculture, the matter contained herein is published as administrative information and is required for the proper transaction of the public business

Vor VI

Washington, November 23, 1927

No. 47

BUREAU OF EDUCATION PLANS COLLEGE SURVEY

To Make Study of Accomplishments, Status, and Objectives of Land-Grant Type of Education

The formation of a special advisory committee of nine members to function to the survey of the land grant colleges of the United States authorized by the last Congress, one of the largest surveys of its kind ever undertaken in the country's history, was announced November 18 by the Department of the Interlor.

The personnel of this committee follows: The Secretary of the Interior, chairman; the Secretary of Agriculture; President R. A. Pearson, of the University of Maryland, College Park, representing the Association of Land Grant Colleges and Universities; President R. S. Wilklnson, of the State agricultural and mechanical college, Orungeburg, S. C., representing the Conference of Negro Land-Grant College Presidents; Francis G. Blair, State superintendent of public Instruction of Illinois, Springfield; President L. D. Coffman, of the University of Minnesota, Minneapolis; President S. W. Stralton, of Massachusetls Institute of Technology, Cambridge; President Charles A. Lory, of the Stale agricultural college of Colorado, Fort Collins; and Miss Martha Van Rensselner, director of the New York State college of home economles, Cornell University, Ithaca.

Congress authorized the expenditure of \$117,000 for this survey. The survey is being conducted by the Bureau of Education of the Department of the Interior.

There are 69 hind-grant colleges, each State and Territory maintaining one for white sludents and 17 States operating additional colleges for colored students. The number of students enrolled in them last year was approximately 327,000, of which 314,000 were while and 13,000 eolored, and on their staffs were 23,188 professors and instructors. All of the institutions are State supported, and their total Income In 1925 26 was \$129,200,000, the Federal Government contributing \$1,134,000.

In convection with the fermation of the special advisory committee, the final

(Continued on page 3)

THANKSGIVING

A Proclamation by the President

tinder the guidance and watchful cure of a divine and ishelicent trovidence this country has been earled safely through another year. Almighty food has continued to bestow upon us the light of His connienance, and we have prospered. Not alone have we enjoyed material success, but we have advanced to wisdom and in spiritual understanding. The products of our fields and our factories and of our manifold activities have been maintained on a high level. We have guined in knowledge of the higher values of life, There has been advancement in our physical well being. We have increased our desire for the things that minister to the mind and to the sout. We have raised the mental and moral standards of life.

We have had the blessings of peace and of honorable and friendly relations with our sister untions throughout the world. Disasters visiting certain of our Sintes have touched the heart of a sympathetic Nation, which has responded generously out of its abundance. In confluence the heart of a sympathetic Nation, which has responded generously out of its abundance, in confluence with time-honored and sacred custon, we should consider the manifold blessings granted to us. While in gratitude we rejote, we should himbly pray that we may be wortby of a confluence of divine favor.

Wherefore, I, Calvia Coolidge, President of the United States, do hereby set apart and designate Thursday, the twenty-fourth day of November, next, as a day of thanksqiving and prayer, and recommend and arge that on that day our people lay aside their usual tasks, and by the family freside and in their accustomed places of public worsbip give thanks to life when he holds us all in the holiow of this hand.

OCTOBER 26, 1927.

PERSONNEL DIRECTOR DISCUSSES PROBLEMS

Doctor Stockberger Wants People of Department to Have the Facts About the Personnel

Dr. W. W. Stockberger, director of personnel and business administration of the department, addressed the most recent of the frequent conferences of extenslon people and others that are held in the office of cooperative extension work in Washington. A number of adminisirative officers of the department being present whose functions involve matters of personnel, he spoke on the subject of "Our mutual personnel problems." Inasmuch as personnel is a limiting factor in all the work of the department, and on account of the fact that administrative officers and the entire rank and file of the department probably have taken more interest in and given more study to personnel matters since the passage of the classification act than in the preceding decade, as much of the address as space will permit is published below in this issue of THE RECORD.

Doctor Stockberger said;

"More than almost anything else, people desire the approval of their assoclates. To a large extent this desire determines conduct; it not only inhibits the tendency to do those things which are generally regarded as unbecoming or reprehensible but also supplies a definite and important slimulus to useful effort. In an organization such as ours approval or appreciation of effort which results in a bronder and more useful service may frequently be expressed by the spoken word, but it normally becomes tangible in the form of promotion or advancement. In fact, growth expressed through promotion or advancement is the very life of an orgunization. We must provide opportunity for this growth in so fur us limitations over which we have no control will permit. One such opportunity lies in promoting employees to vacuncies in higher grades in accordance

(Continued on page 8)



PERSONNEL DIRECTOR **DISCUSSES PROBLEMS**

(Continued from page 1)

with the general policy of the department to fill vacancies by promotion from within. There appears to be no lack of opportunity for the promotion to higher grades of many of those who are fitted to assume greater responsibilities. During the calendar year 1926 alone 468 employees in Washington, more than 10 percent of the entire personnel, were promoted to higher grades.

"We must also provide for reasonable

We must also provide for reasonable we must also provide for reasonable increases in salary when warranted by growth in experience or responsibilities. The selection of employees for advancement should be made carefully and judiciously. It is easy to fall into a lock-step method of selection and to say 'This year we will advance this group and next year that group.' Such a method destroys initiative and discounts efficiency. Advancement should be slow or rapid, according to the rate of growth Frequently we bring the employee. of the employee. Frequently we bring into the service a young individual who has outstanding capabilities. Instead of placing him in a low-salary class and keeping him there until he has lost all life and enthusiasm, we should provide his advancement as rapidly ability warrants. I do not favor advancement on the basis of seniority alone, but, other things being equal, seniority may well be the deciding factor.

"We may also look at this question of opportunity for advancement from an entirely different point of view. At the end

tirely different point of view. At the end of the calendar year 1926 there were 606 employees on the Washington rolls who had been in the service for 20 years or more. In 1906 the average salary of this more. In 1906 the average salary of this group was \$1,178 and in 1926 it was \$2,815, an increase of 138 per cent. Of this increase, 49 per cent occurred during the first decade and 89 per cent during the second decade. There was also on the rolls in 1926 a group of 331 employees who entered the service in 1917 at salaries which averaged \$1,065. In 1926 the average salary was \$2,127, which represents an increase of 99 per cent in 10 years of service. A third group of 226 resents an increase of 55 per cent in 105 years of service. A third group of 226 employees who entered the service in 1921 at salaries averaging \$1,316 had reached an average of \$1,902 in 1926, an increase of 44.5 per cent in five years of service.

"Thus far averages only have been dealt with. It will now be interesting to consider the fortunes of some indito consider the fortunes of some individuals who were on an equal salary basis at the beginning of the periods undiscussion. In the professional and scientific group that has had 20 or more years of service there are 34 employees each of whom was receiving a salary of \$1,200 in 1906. The fowest salary received by an individual of this group in 1926 was \$2,400, an increase of 100 per cent, and the highest salary was \$5,600, an increase of 365 per cent. There were four at \$3,000, four at \$3,800, and three at \$5,200, with the others distributed with fair regularity over the intervening salary rates. In the clerical group that has had 20 or more years of service there are 37 employees each of whom was receiving a salary of \$720 in 1906. The iowest salary received by anyone in this group in 1926 was \$1,200, an increase of 75 per cent, and the highest salary was \$3,200,

an increase of 341 per cent. Nine of these employees were receiving salaries of \$2,000 or more. Various reasons are frequently given for this unequal distribution over the salary scale of those who were on a parity in 1906, some of them plansible and others highly improbable. Relative age, at least for the professional group, does not appear to be a factor of much importance, since the average age of the professional employees now receiving salaries ranging from an increase of 341 per cent. Nine of now receiving salaries ranging from \$2,400 to \$3,000 is the same as the average age of those receiving more than In the clerical group the average age of employees now receiving less than \$2,000 is five years in excess of the average of those receiving more than \$2,000. These facts are interesting so far as these two small groups are concerned, but the number of cases studied is far too small to permit drawing any general con-clusions on this point. It is evident that there must be some definite reasons for there must be some definite reasons for such great inequalities in the progress of employees over a period of years. The most important apparently are: (1) Edu-cation and training; (2) social intelli-gence; and (3) the accident of circum-

stance.

"(1) Education and training, whether received in academic halls or the school of experience, apparently play an important part in the advancement of an individual. To determine the relation of education and training to the grade of position held, I examined the records of the 231 employees in the professional service who in 1926 had been on the rolls service who in 1920 had been on the rolls of the department for 20 years or more, and divided them into four groups: First, those who had no academic degree; second, those who had only a bachelor's degree; third, those who had a master's degree; and fourth, those who had a doctor's degree. This iast group was subdivided into those who held or earned honorary degrees, respectively. I found that of these 231 cmployees 59 were classified in Grade P-5, 5 having no degree, 12 the bachelor's degree, 20 the master's degree, and 22 the doctor's degree, 15 earned and 7 honorary. There are 76 employees in Grade P-4, 8 having no degree, 35 the bachelor's degree, 18 the master's degree, and 16 the doctor's degree, 13 earned and 3 honorary. In each degree class the percentage of the employees who have been advanced to Grade P-5 or higher is as follows: of the department for 20 years or more,

a to or menor to do fortono.	Per	cent
No degree		15.6
Bachelor's degree		19. 7
Master's degree		88. 5
Doctor's degree, earned		44. 4
Doctor's degree, honorary		80. 0

"Similarly, the percentage of the employees in each degree class who in 1926 were classified in Grade P-4 is:

242	F C 24	81
No degree	25. 0	0
Bachelor's degree	87. 8	
Master's degree	31.	
Doctor's degree, earned.	86. 1	
Doctor's degree, honorary	20.0	0

"These figures indicate very clearly that factors other than the attainment of an academic degree have contributed materially to the progress of many individuals rially to the progress of many individuals in this group, otherwise we would not have 5 men without a degree and 12 men with the bachelor - degree only in Grade P-5.

"(2) The general term 'intelligence' has been humorously defined as the relative amount of dumbness a person pos-

senses, but as a factor in personal prog-ress there is something in addition to that characteristic which largely determines success or failure. I have tried to define that something as social intelligence— that group of personality traits which determines the conduct of an individual in his relation and contacts with his in his relation and contacts with his fellow nieu. We all know some very intelligent people who are not able satisfactorily to discharge the duties of their positions. We all know some highly educated people who are all right in their special field but who often make fools of themselves when they get late fields other special field but who often make fools of themselves when they get into fields other than their own. They are lacking in the characteristic of social intelligence. You know how we almost instinctively pick out one person and say 'He is a good man for such and such a position,' and of another we will say 'Yes, he is well qualified in many respects, bnt—' and it is the 'bnt,' the lack of a desirable degree of social intelligence, that often closes the door of opportunity.

"I believe that self-examination or introspection of the proper kind is a very

trospection of the proper kind is a very important factor in an individual's sncimportant factor in an individual's success. It is the proper corrective for that attitude of mind which prompts an individual to evade his own responsibility and to hold some one else as always responsible for his failure to make satisfactory progress. All too frequently administrative officers are criticized by certain amplement who say that they do certain employees who say that they do not get on as fast as they merit, that their efficiency ratings are too low, that their supervisors are biased, or prejndiced and favor others at their expense. diced and favor others at their expense. This tendency to biame somebody else when we are at fault is a mental defense mechanism, a projected self-criticism. Much useless worry and nervous wear and tear could be avoided if clear recognition were given the fact that the primary causes which determine satisfactory personal progress as well as the lack of such progress are to be found in the individual himself.

"(3) Two men of equal ability and

"(3) Two men of equal ability and qualifications may enter the department at the same time but in different bureaus or different divisions of the same bureau. One may find that changes in organization or vacancies occurring in higher grades will afford him frequent opportunities for promotion while the other may find himself in a stable organization with little or no opportunity for advancement. Again, unforseen events may occur which will bring one man's work into special prominence and win for him unusual advancement while his colleague may be less fortunate though equally capable. So the accident of circumstance plays its part, leaving one in a blind alley and setting the feet of the other on the pathway of progress. or different divisions of the same bureau.

other on the pathway of progress.

"Another matter which should engage the serious consideration of administrative officers is the amount of misinformation which is abroad among our employees with respect to promotions, efficiency ratings, classification, and other textures. efficiency ratings, classification, and other features of administrative procedure which affect their welfare. For example: There appears to be a belief current among certain employees that when promotions are made the 'higher ups' receive the lion's share, or that the scientific employees are unduly favored at the expense of the clerical workers. Now, what are the facts in the case?



At the last semiannual salary adjustment on July 1, 1927, the professional and scientific employees received 43 per cent and the clerical employees 41 per cent of the total increase granted. The remaining 16 per cent was divided between the subprofessional and custodial grades. subprofessional and custodial grades. Of the increase in the professional and sclen-tific service, 51 per cent went to the first three grades, and of the increase in the clerical, administrative, and fiscal serv-ice 70 per cent went to grades 1 to 5, inclusive. As to the number of increases, 31.3 per cent of the prefessional em-ployees, 24.5 per cent of the subprofes-sional employees, 27.6 per cent of the clerical employees, and 17.5 per cent of the custodial employees were advanced in salary.

"The classification act has been severely criticized, largely, I believe, because its major purpose has been misunderstood. It did not prove to be a general salary increase act, as had been expected, and many employees received no immediate financial benefit at the time the act went into effect. On July 1, 1924, there were 4,589 employees of this dethere were 4,589 employees of this de-partment in Washington who came under its provisions. Of this number, 1,515, or 33 per cent, received no increase in com-pensation as a result of the act aside from the bonus, which was automatically made a permanent part of the hasle salary. The number and percentage of employees who received no increase in eompensation is as follows:

Per cent --- 26 --- 38. 5 Professional service (285) 26
Subprofessional service (201) 38.5
Clericni, administrative, fiscal service (631) 27.6
Custodial service (398) 58.1

"I fear that failure to receive immediate pecuniary benefit under the act has hlinded many of our employees to its numerous and permanent advantages to the department as a whole. "The Classification Board also is a

subject of criticism for its fallure to approve some of the recommendations sub-mitted to it by the department. During the calendar year 1926 I sent to the board 1,465 classification sheets covering new positions or changes in duties. Of these recommendations the board approved 97.6 per cent. This is a very good batting average, yet one disapproval causes much more comment than a hundred approvals.
"If more information,

more facts, about the personnel situation were made available to the employees generally, idle rumor and unwarranted criticism would give way to a more intelligent and more sympathetic understanding of our mutual personnel problems."

NEWS OF THE PERSONNEL

BIOLOGICAL SURVEY

John W. Meyer, office of exhibits, extension service, has been transferred to the division of fur resources of the Bureau of Biological Survey, and is stationed at the rabbit experiment station at Fontana, Chiff. He recently spent a month at the fur-animal experiment station of the bureau at Saratoga Springs, N. Y., studying the experiments going on there prior to leaving for the West.

EXTENSION SERVICE

Arkansas.—G. K. Aivord, for several years a
teacher of vocational agriculture at North,
S. C., has been appointed county agent in
Calhoun County, to succeed H. G. Dasher,
resigned to go into business.

NEW PUBLICATIONS ISSUED BY THE DEPARTMENT

The Citrus Insects of Japan. (Technical Bulletin 15-T.) By Curtis P. Clausen, extomologist, Japanese beetle investigations, Bureau of Entomology. Pp. 16, figs. 5. October 1007 Entomology.

A semitechnical publication, summarizing the information now available regarding the insect pests attacking citrus in Japan, for the information of entomologists and citrus growers. Japaneae publications dealing with these insects are largely in the vernicular, and consequently not available to foreign workers. Twelve species of major importance are listed, as well as 30 of less coosequence, and data are presented upon the life histories, inbits, and control of many of them.

tories, inbits, and control of many of them.

Monthly Weather Review, Vol. 55, No. 8,
August 1927. Pp. 349-385, II.

SPECIAL ARTICLES:

Abnormal summers in the United Statea.

A. J. Henry.

The protection of strawberries from frost through artificial heating. Aibert W. Cook.

Some recent treasures of the snow. Wilson A. Bentley.

C. E. P. Brooks on the effect of fluctuations of the Guif Stream on the diatrillution of pressure. A. J. Heory.

Improved water-flow pyrhellometer. W. M. Shulgin.

Analysis of the precipitation of rain and

Shulgiu,
Aualysis of the precipitation of rain and
snow at Mount Vernon, lowa. Robert
W. Hendricks.
Oue unit of radiation used in meteorological
treatises on actioometry. Anders Angostrom.

Journal of Agricu'tural Research. Voi. 35, No. No. 5. September 1, 1927. Pp. 385-480, il. CONTENTS:

The utilization of carbohyrntes by honeybees. (N. Y. (Cornell) 11.) E. F. Phillipa.

The utilization of carbohydrates as food by honeybee larvae. (K-194.) L. M. Bertholf.

A root rot of lucretla dewberry cansed by a variety of Collydin dryophila Fr. (N. C.-24). R. F. 1700le.
I'omegranate Blotch. (G-688.) Frederick A. Wolf.

Subcultaneous tumor in a primate caused by tapeworm larvae experimentally reared to maturity la degs. (A-110.) itenjamin Schwartz.

Journal of Agricultural Research, Vol. 35, N G. September 15, 1927, Pp. 481-576, IL

6. September 10, 1921;
CONTENTA:
Studies of the physiological anatomy of the
strawberry. (6.585.) Thilly R. White.
Comparative studies of winter hardiness in
wheat. (G-580.) John fi. Martin.
The seeds of quack grass and certain wheat
grasses compared. (G-593.) Helen H.
Linge.

The seeds of quack grass and certain wheat grasses compared. (G-593.) ilelen II. Henry.

The taxic constituent of richweed or white snakeroot (Enpatorium urricaefolium). (A-120.) James Fitton Couch.

Plant Material Introduced by the Office of Foreign Plant Introduced by the Office of Foreign Plant Introducion, Hureau of Plant Industry, During the Period from July 1 to September 30, 1925. (Nos. 64429 to 65047.) (Inventory No. 84.) Pp. 36. November 1927.

Soil Survey of Grant County, South Dakota. By W. I. Watkins, of the U. S. Department of Agriculture, and W. II. Pierre, of the South Dakota Agricultural Experiment Station. Pp. 31, fig., mnp. (From F. O. Soiis, 1922.)

Experiment Station Record. Vol. 57, No. 7. November 1927. Pp. 601-700.

November 1927. Pp. 601-700.

The Superintendent of Documents, Government Printing Office, Washington, D. C., has for sale many publications traved by this department which are no longer available free. He will send free price lists of them upon request. Readers of The Record may render a service in the distribution of the department's information by telling those with whom they come in contact of the availability of these free price lists.

New Jersey.—Alice M. Seely, a home economies teacher in the Jersey City public schools, has been appointed county club agunt in Oceaa County to succeed Elsie R. Horne, resigned, and she will also carry on club work in home economics. John E. Brockett, a graduate of Connecticnt Agricultural College, has heen appointed assistant bonuty agent in Atlantic Connty. S. S. Stabler has resigned as county agent in Cape May County.

Tennessee.—Mrs. H. M. Trull, home demonstration agent in Sumner County, has resigned to attend George Peabody College. Minule Ruth Stephens has succeeded Marvel Bass as home demonstration agent in Lawrence County.

home demonstration agent in Lawrence County.
Virginio.—Kent Apperaon, assistant extension horticulturist, will resign November 31 to manage two large orchards lu the State. G. W. Patterson, extension agronomist, will resign December 31 to take a position with the Chilean Nitrate Co.
Michigan.—C. V. Oviatt, who has been operating a large farm, has been appointed extension specialist in sugar-beet culture. II. F. Moxley, a county agent in Kansas, will become extension specialist In animal husbandry, January 1, 1928.

EXPERIMENT STATION PUBLICATIONS

The Office, of Experiment Stations has just received for its library files copies of the following publications of the State experiment stations. Copies may be obtained from the stations issning them.

This deportment has no supply of them for publication.

publication.

Oroamental vines. H. Mowry. (Florida Sta. Bul. 188, p. 183-230, 51 ags. June 1927.)

Bed rot of sweet potatoes. B. B. Higgins. (Georgia Sta. Circ. 80, p. 218-221, 1 ag. Sept. 1927.)

Home-cured pork. F. R. Edwards. (Georgia Sta. Circ. 81, p. 222-225, 1 ag. Sept. 1927.)

Meteorological observations at the Massanchn-setts Agricultural Experiment Station. J. E. Ostraader and H. Baumgartner. (Massachnsetta Stn. Met. Hul. 466, 4 p. Oct. 1927.)

Sngrain. W. E. Ayres and H. A. York. (Misalssippi Sta. Circ. 72, 4 p. Mar. 1927.)

I'owdery mildew of peaa. R. F. Crawford.
(New Mexico Sta. Bni. 163, 13 p., 3 figs.
June 1927.)
The rural health facilities of Ross County,
Ohio. C. E. Lively and P. G. Beck. (Ohio
Sta. Rni. 412, 54 p., 1 fig. Oct. 1927.)
Spraying for prevention of apple hiotch
(Phyllosticta solitaria) and apple scah (Venturia inacqualis). F. Ii. Buliou and I. P.
Lewis. (Ohio Sta. Bui. 413, 32 p., 1 pl., 11
figs. Oct. 1927.)
The vsiue of certain scratch grains in the
poultry ration. R. Penquite, R. B. Thompson, and II. R. Naylor. (Oktahoma Sta. Bul.
166, 8 p., 5 figs. [1927].)
Small grain experiments. T. S. Bule, W. B.
itogera, and J. D. Warner. (South Caroilna Sta. Bul. 242, 20 p., 5 figs. Oct. 1927.)
Fsctors affecting returns from the dairy enterprise in the Shenandoah Valley. J. J.
Vernon, C. W. Holdaway, M. Ezcklei, and
it. S. Kifer. (Virginia Sta. Bul. 257, 87 p.,
16 figs. Jane 1927.)
Manure and electric botheds. Ii. L. Garver
and C. L. Vinceat. (Washington Col. Sta.
Bul. 220, 35 p., 7 figs. Sept. 1927.)
Feeding affsifa hay. J. Sotola. (Washington
Col. Sta. Itul. 220, 35 p., 7 figs. Sept. 1927.)
Fiberi culture. II. D. Locklin. (Western
Washington Sta. Pop. Bul. 6—W, 32 p., 9
figs. Oct. 1927.)
Organic food reaerves in relation to the growth
of alfalfs and other perennial herbaceous
plants. L. F. Graber, N. T. Nelson, W. A.
Leukel, and W. B. Albert. (Wisconsin Sta.
Research Bul. 80, 128 p., 35 figs. Aug.

Nearly \$400,000 worth of blackberries, raspberries, huckleberries, and peaches was sold on the farmers' market at Hamwas sold on the farmers' market at Hammonton, N. J., this year. Prices were received that were higher than the delivered prices at New York City, under a project sponsored by the New Jersey Department of Agriculture. Bnyers' trucks went to Hammonton from as far away as Pittsburgh and Boston.



"Once it was a record-keeping joh only, but now the swaddling clothes have heen discarded and the sturdy boy is venturing into broader fields involving recruiting, classification, research, placement, instruction, and training on the job. The ultimate goal of all Government personnel work is to create harmony between the worker and his administrator, so that both organization and employee derive the maximum benefit."

it is just as important, in Mr. Rehlaender's opinion, for the department to keep abreast of the times in administering its personnel matters as it is to conduct its research on a plane with the most modern science.

What College or University Trained Most Department Men?

In an address recently delivered before a conference on university training for service in the various departments of the National Government, Dr. W. W. Stockberger, Director of Personnel and Business Administration, included, among the many statistics presented, lists of the colleges and universities that had conferred their degrees upon the department's professional workers.

Cornell, with 16; the University of Michigan and the University of Wisconsin, with 10 aplece; and Harvard, with 8, head the list for the P-6 group.

The Agricultural and Mechanicai Coilege of Texas trained the largest number, 21, of agricultural economists, the University of Minnesota, with 8, and the Iowa State College and the University of Illinois, with 7 each, following.

Twenty-eight department agronomists hold degrees from Kansas State Agricultural College, 9 from Oregon State Agricultural College, 7 from Montana State College, 6 from Iowa State College, 6 from South Dakota Agricultural College, and 6 from Utah Agricultural College.

George Washington University gave the department 26 of its chemists; the University of Illinois, 17; Corneli University, 10; and Harvard and the Universities of Michigan, Nebraska, and Wisconsin, 9 each.

Of the 365 entomologists, 48 attended the Massachusetts Agricultural College; 34, the Mississippi Agricultural and Mechanicai College; 17, Ohio State University; 14, the University of Illinois; 13, the University of Kansas; 13, Clemson Agricultural College; 13, Kansas State Agricultural College; 11, Cornell University; and 10, Stanford University. The University of Minnesota and the University of Nebraska each educated University of Nebraska each educated

The University of Minnesota and the University of Nebraska each educated 11 of the department's plant pathologists, while Michigan State College of Agriculture trained 9 and the University of Wisconsin 8.

Among the outstanding food values in the markets at present are the various kinds and forms of fish that are found in the interior as well as along the seacoast, according to the Bureau of Home Economics. Bargain rates are to be found especially in canned pink salmon and the large sized sardines which are packed in tomato sauce.

Federal Informational Services Discussed by U. S. Daily Editor

"Every now and then some one takes a fling at bureaucracy and illustrates the point by singling out some apparently inconsequential activity of Government and holding it up to cynicism or ridicule," said David Lawrence, Editor of the United States Daily, in a recent radio address. "Too often the offenders concent a true purpose to ward off the regulatory arm of the Government. Too often the attack on Government is a camouflage on the part of those who wish to evade or avoid the law. Too often it is an effort to weaken all authority.

"The Federal Government, as is well known, now is spending annually something over \$4,000,000,000. About five-eighths of this sum is devoted to war debts, war pensions, and maintenance of the national defense. The next largest single item, estimated by the President at more than half a billion dollars a year, goes toward service to the public in the form of aids to health, education, agriculture, industry, commerce, and transport by land, water, or air. A large part of this service consists of information which the Government has gone to considerable effort and expense to collect. "Is there sufficient demand for this

"Is there sufficient demand for this service to justify the expense of furnishing it? The question is one that is often asked and it is one that the people have a right to ask, since they are the ones to foot the bill. Let us see what the agencles of the Government most concerned have to say about it.

"Two of the 10 executive departments of the Government furnish most of this service of Information. They are the Department of Commerce and the Department of Agriculture. The law which created the Department of Commerce dedicated it to fostering, promoting, and developing the nation's commercial, industrial, and transportation interests. In the words of Dr. Jullus Klein, Assistant Secretary of Commerce, the blg work of the department is in the gathering and distribution of industrial and commercial information because that has proven itself to be the best way in which to foster and promote the general economic welfare—not to teil the people what they ought to do, but to give them the facts and let them make their own plans accordingly.

"The Department of Agriculture is a service institution for the entire nation with many duties which affect nonagricultural interests. Its original task of collecting and issuing agricultural information from one office has broadened until to-day the entire continental United States, the insular possessions, and many foreign countries serve as the department's laboratory. The collection of facts has developed into technical and scientific research in the biology of plants and animals. The dissemination of information now necessitates the printing for free distribution of 30,000,000 copies of publications annually. It requires the work of a press service, a vast extension service, an office of ex-

hibits, an office of motion pictures, and a radio service. The department's work in plant breeding, in introducing valuable plants from abroad, in excluding or eradicating plant and animal pests, in disseminating vital weather information, and in many other fields develops new knowledge faster than it can be published.

"The publishing program of the Department of Agriculture is the outgrowth of 68 years' experience and is adapted as closely as possible to the needs of farmers, research institutions, extension groups, and the general public. In addition to the 30,000,000 copies of publications distributed free each year, another million copies are sold hy the Superintendent of Documents at prices barely covering the cost of printing. By law, Members of Congress are entitled to distribute four-fifths of all copies of the farmers' bulletins. Besides the printed publications, much material, both technical and popular, is issued in nilmeograph form. The annual output of such material is about 52,000,000 pages.

"The press service of the department Issues annually about 1,200 releases direct to newspapers, press associations, and correspondents. These releases disseminate current news and timely information about the department's work. Ahout 3,500 newspapers are reached weekly through various syndicates which use informative articles on agriculture. Department workers place about 1,400 articles annually in nongovernmental publications.

"About 90 per cent of the farmers in the United States take one or more farm journals. About 75 per cent take a daily newspaper and more than 55 per cent take a weekly newspaper. Much information furnished by the Department of Agriculture is brought to the notice of farmers through these publications. Material is often written especially for their use. Data handled through the department's press service is referred to all interested authorities before being released. A story about insecticides, for example, may require the approval of the chemists who study the poisons, the entomologists who study the insects, and the plant scientists who study the plants on which the insects feed. Individual newspaper reports could hardly be expected to go to such lengths to secure comprehensiveness on such a technical subject.

"The radio service of the Department of Agriculture was established in 1925. Previously the department had used the radio only for weather reports and commodity market news. To-day about 50 per cent of the 600 or more radio stations in the United States cooperate daily with the department. Some broadcast only market news. Two hundred stations, however, carry daily educational programs also. Farmers and others like to hear the agricultural scientists and economists and specialists of the department themselves over the air. The National Broadcasting Company puts at the department's disposal without charge five days each week a chain of about 40 stations by which menns voices from Washington may be heard in all parts of the country."



As I See It

Observations of a Civil Servant

50 Essayettes of 150 Words

BY

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UNITED STATES DEPARTMENT OF AGRICULTURE

The Graduate School

United States Department of Agriculture

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1941

WARNER W. STOCKBERGER

Long ago he was a research worker with drug plants and a division chief in the Department of Agriculture. But his hobby was studying and improving human relationships among employees. Nowadays this is called personnel administration.

The hobby became his life work when he was appointed the Department's first Director of Personnel in 1925, shortly after the Classification Act was passed by Congress. He held this post until 1938. And because of his pioneering achievements, the Department became widely known as a leader in wise personnel administration.

These miniature essays are distilled from a rich experience in human relationships.

Each one of them is exactly one hundred and fifty words long—almost as brief as a Chinese poem. Each presents a different facet of a philosophy of work—particularly a philosophy of work for people in the Government service.

Doctor Stockberger took time to think. These little essays grew out of contemplation as well as experience. They reveal the man better than anything that could be said about him.

He never regarded employees in the Government as masses of people. They were always individuals.

The essays are the thoughts of an individual addressed to individuals about fundamental things that concern each of us.



Accident of Circumstance

THE ACCIDENT of circumstance is far more important than deliberate planning in shaping individual careers. Young people entering college often elect to specialize in a field which appears to offer excellent opportunities for employment and future advancement, only to find on graduation candidates for positions are far in excess of the demand, and find themselves doing other work for which they are not as well prepared. Or, two persons of equal ability and attainments obtain identical positions in the same organization, but in different divisions. In one, turnover in the higher positions may be rapid, thus affording opportunity for frequent promotions; in the other, it may be negligible, bringing little or no opportunity for advancement. Again, unforeseen events may bring prestige to one, leaving his equally capable colleague unknown. So the accident of circumstance plays its part, barring opportunity for one and opening to the other the pathway to success.

Allegiance to Position

Some kings have lost their heads because of the delusion that they and the State were one. Some lesser individuals vested with authority or responsibility in large degree also lose their heads, figuratively, when they arrogate to themselves personally the loyalty, deference, honor, and respect which is rightfully rendered to the position rather than to its occupant. Such persons apparently do not appreciate the fact that while individuals may come and go, the position with all its accessories and adjuncts continues on.

The distinction between a position and its occupant must be clearly understood by the rank and file of an organization if morale is to be maintained following a change in leadership. No charge of disloyalty can be sustained against those who faithfully serve the new leader. Obviously a change in leadership affords no justification for withholding or curtailing that continuing allegiance to which the leader's position is entitled.

An Obligation

ALL who stand in a supervisory relation to others must realize the important part each and every one plays in the effective utilization of our human resources. It is a matter of common knowledge that the personnel of every division or working group in an organization is very responsive to the attitude of the leader to whom they are responsible. The taking upon oneself of direct authority over other persons, therefore, carries with it a definite and binding obligation to use it wisely and judiciously. It implies an understanding of the causative factors of human behavior and of the methods of influencing it favorably; it implies the capacity to analyze the effect of different policies upon human beings in all their complex working relationships; and it implies the ability and purpose to be ever considerate of the interests of employees and zealous in their protection against arbitrary or unfair treatment.

Attitudes

ATTITUDE is a state of mind which may find expression in behavior or conduct. Environment, education, associates, and experiences, all exert a determining influence on the formation and nature of our attitudes. Since these factors vary with almost every individual, the attitude of each toward any given object or purpose differs correspondingly. The attitude of every person, as revealed through behavior or conduct, may become different with each change in relations or circumstances. Thus the attitude toward a superior may be respectful, deferential or obsequious, but arrogant, arbitrary or domineering toward subordinates; or overindulgent toward the familiar and accustomed, but skeptical and suspicious toward the new and strange.

Attitudes are not always logical, reasonable, justifiable or sensible. If inflexibly maintained they become obstacles to progress. Critical self analysis will often reveal faulty attitudes and their cause. They can be modified or changed, but only through the exercise of will power.

Better Speech

KEEN OBSERVERS have pointed out as a significant fact that many great business executives have command of unusually large vocabularies and that the clarity and precision of their diction arrests attention. Although the process of acquiring a comprehensive vocabulary does not forthwith transform a person into a great executive, it does develop the ability to present ideas forcefully and effectively.

In ordinary discourse the wearisome repetition of trite and hackneyed words and phrases suggests either mental inertia or lack of familiarity with acceptable forms of clear and precise expression. Also the profanity with which the conversation of some individuals is abundantly interlarded may have some justification as a means of emphasis or on the basis of a release for strong emotion. But all too frequently it is irrelevant or inappropriate and annoys and irritates the listener. Moreover it is a mechanism for concealing a deficient vocabulary or absence of serious thought.

Cacoethes Loquendi

"TALK IS CHEAP," declares an old adage. That there is much cheap talk may also be asserted. The propensity to talk overmuch materializes in an intemperance of words. "No one can be an orator sitting down," said a former Secretary of Agriculture, but neither sitting nor standing diminishes the flow of verbal utterances of the truly loquacious person.

In almost every group which meets for discussion there is one or more individuals who, if unrestrained, would monopolize the conversation. They are oblivious or indifferent to their want of courtesy toward the others present who also have something to say. Likewise, loquacity produces letters of triple the necessary length, voluminous reports shot through with irrelevant details, and long and verbose oral explanations which bemuse and weary the listener. The fine gold of intelligent conversation is alloyed with the dross of loquacity. The formula for its purification is: talk less; think more.

Capital

CAPITAL is usually thought of as wealth available for supplying the needs and desires of human existence. Its unequal distribution has resulted in a perennial series of economic and social problems. When idle, capital produces nothing and restricts the opportunity for workmen to obtain employment. Flagrant abuses of privilege and violation of human rights have attended the efforts of many individuals to amass wealth. The power and influence exerted through large aggregations of property have produced conditions which compel thousands of persons to forego all thought of acquiring wealth in excess of a modest competence. Yet in his brains and skill every individual has a form of capital which, judiciously employed, will yield gratifying results. Capital in this form is not taxable, is not lost in times of panic or depression, and is safe from impairment by active competition. However, unused brains and skill, like idle capital, yield no returns.

Conditioned Response

A young LAD attending a circus was attracted by a feature loudly advertised as an "Educated Pig." To enable the pig to display his "learning," short strips of cloth on which certain brief sentences had been painted were placed on the floor before him. In response to each of a series of questions put by the exhibitor, the pig would pick up and bring to his master the strip of cloth bearing the appropriate answer.

The procedure which results in conditioned response should not be confused with or mistaken for the educative process. True education is something other than a conditioned response or the mere accumulation of facts. It is an internal metamorphosis and development of an individual's mental behavior.

The alleged learning of the animal was only an automatic response, developed by long training, to recognitory cues disclosed by the form of the questions. The pig was still only a pig.

Conservatism

Conservatism is a deep-seated human trait which becomes manifest as disinclination or opposition to any change in the existing order. It shrinks from the new and the strange, clings to well-established customs and procedures, and retards even when it does not prevent progress. It is not aware of, or ignores the necessity for change without which progress can not take place. Fear inspired by an impending change develops attitudes which simulate conservatism. Even at rumors of a change the imagination conjures up all sorts of dire possibilities which may result, but anticipation is usually fantastic when compared with realization.

Changes in an organization inevitably take place as a necessary part of its growth and development. Opportunities for recognition and advancement are far greater in progressively changing organizations than in those where ultra-conservatism constantly inhibits progress. Organizations must change to keep pace with social and economic advances and to avoid fossilization.

Counseling

"Trouble shared is trouble halved," is an old axiom. The extent of the practice of sharing troubles, of seeking counsel or advice in personal difficulties, is perhaps not generally realized. A recent survey disclosed that many persons in widely differing professions or callings are engaged in counseling. Among them are ministers, lecturers, psychologists, vocational counselors, writers, columnists, sectarian practitioners, physical therapists, numerologists, graphologists, spiritualists, and numerous others. The motives which impel people to seek advice probably vary as widely as the ability, sincerity and purpose of those who are consulted. Much of the advice given may be of doubtful value, nevertheless it is a response to a very real human need.

In every employed group there are always individuals with financial, educational or other personal problems who could be aided to resolve them if wise and sympathetic counsel were provided. Counseling can have an important place in effective personnel administration.

Curiosity

Although it is often alleged that curiosity killed the cat, the circumstances which precipitated the fatality are never revealed. It is implied, however, that undue inquisitiveness was exhibited without reasonable caution and prudence. But neither caution nor prudence can relieve from condemnation that curiosity which takes the form of prying into the private affairs of others. On the other hand, the lack of inquiring and laudable curiosity has here and there ruined the chances of persons for recognition and advancement. The lack of curiosity inclines to narrow-mindedness, acceptance of routine, circumscription of interest, and indifference to the ideas that engage the serious attention of others.

Intelligent curiosity arouses an eagerness for information and a desire to acquire useful knowledge. Purposefully directed it responds to the perennial challenge of new fields awaiting exploration. The natural result is a continued learning, sustained thinking, and the development of a versatile and open mind.

Democracy

EVERYBODY is talking about democracy these days, some to extol its virtues, others to predict its ultimate downfall. It is often thought of merely as a form of government, but it is more than a form of government. It is the embodiment of the right of every individual to share in the consideration of problems which relate to his welfare or destiny.

Too many persons today are concerned more for what democracy can do for them than for what they can do for democracy. Too many persons think only of the individual freedom guaranteed by democracy and disregard the social responsibilities they must bear to insure that freedom. Democracy is a way of life of a people. It concerns the responsibilities and duties of the government to the citizenry and the rights, duties and responsibilities of individuals in relation to their government and to the society in which they live.

Democratic Administration

Administration, conditioned by the form of the organization and following the line of least resistance, tends primarily to become autocratic; but it becomes democratic when it is motivated by supreme respect for human personalities and encourages employees to work jointly for the common good on a basis of critical justice and equality. In administration, the democratic way provides for freedom of individual expression and, through cooperative effort, seeks to gain voluntary compliance with those policies or procedures which majority opinion considers the most desirable.

Democratic administration, however, does not imply that equality of responsibility which inures to the citizenry by virtue of the ballot. Democratic administration cannot survive without authoritative leadership and without recognition of the right of the leader to exercise his authority. It is different from autocratic administration, not in the possession and *use* of authority, but in the *manner* and cooperative spirit in which it is used.

Discipline

No one is fully competent to enforce discipline upon others unless he has first learned the art of self-discipline or self-control. This implies not only control of emotional impulses but also the ability to consider impartially all the facts bearing upon the case. The effect of corrective measures does not cease with the person immediately concerned but is felt by the entire working group of which he is a member. If the discipline is considered too rigorous or not wholly merited, the group spirit sustains a shock, resentments are aroused and morale is impaired.

The literal application of the dictum "like penalties for like offenses" may readily lead to grave injustice. It is pertinent to inquire when offenses are "like" and on what basis likeness is determined. Offenses nominally or superficially alike may in reality differ so greatly that uniformity in the corrective measures applied would in effect be discriminatory.

Efficiency Ratings

By RECOGNIZING the need for efficiency ratings, the validity of the assumption that all employees are not equally efficient is admitted. It follows, therefore, that some will be rated high, others low. Employees are well aware that their associates differ in efficiency. If all were rated high, the really efficient would have just cause for dissatisfaction. But the less efficient, unconvinced that a low rating is deserved, often allege discrimination. The rating officer's lot is not a happy one.

Probably no efficiency rating system can be devised that will give results satisfactory to all who are rated by it. The attitude of some rating officers is liberal, that of others conservative. As a result ratings vary more widely than is justified. Mathematical adjustments of the ratings are deceptive since they merely conceal but do not correct basic discrepancies. Thorough preliminary training of the rating officers is the only practical solution.

Employee Organizations

The first union of federal employees met with disfavor in administrative circles, probably because of a fear of encroachment upon official prerogatives. The right of employees to organize, then questioned, has since been established by statute. Individuals who now use coercion to restrain their employees from participating in union activities are out of sympathy with modern tendencies in government. Employees who are dominated by self-interest or have undue concern for immediate personal benefit may lack either effective leadership or appreciation of their obligations to the government which they have undertaken to serve.

What was once needed and still would be salutary at the present time is a thorough exploration of employer-employee relationships and of their mutual responsibilities and advantages. The trend today is to break down such barriers as may exist between management and employee organizations and to recognize them as potential mechanisms for the more effective functioning of government.

Experience

THE ASSUMPTION that the value of experience is directly proportional to its duration or length is a fallacy. Experience of three, five or ten years in some line of work is, in itself, no guarantee of a corresponding increase in knowledge, skill or ability to do the work in hand. Indeed, long unvaried experience, particularly when the daily tasks are repetitive, is likely to be a liability rather than an asset. It tends to develop habits of thought and action which eventually become routines in which flexibility and adaptability undergo atrophy. Consequently the training of inexperienced persons in new kinds of work is less difficult than retraining those who have developed routines through experience.

Mere duration does not necessarily indicate successful experience, or the acquisition of new skills or an increase in the powers of perception and judgment. Experience must be appraised in terms of increased capacity to render service.

Seventeen

Friendship

FRIENDSHIP nurtures and develops the human spirit just as the glowing sun and the gentle rain of summer call forth the beauty and glory of leaf and flower. Joys and pleasures reach their fullest satisfaction only when shared with friends. Likewise when sorrows and troubles come, their burden is lessened by the sympathy and thoughtful ministrations of true friends. Wealth, power, fame or renown become as ashes of regret and disappointment if in attaining them friendships have been forfeited or sacrificed. All the material trappings of life may be swept away but unchanging friendship remains to console and sustain the spirit through the unfolding years.

Friendship deafens the ear to idle gossip or malicious rumor. It is self-giving rather than self-seeking and is bestowed without thought or expectation of a compensating return. It brings happiness to youth, contentment to maturity, solace to age. Time or absence but cement its bonds.

Gossip

When a drop of blood from the heart of the dragon Fafner fell upon the hand of Sieg-fried it burned like the cruellest fire. Likewise evil and malevolent words of gossip scorch and scarify the character and uprightness of the persons concerning whom they are spoken. Malign gossip is the spawn of a malicious and prurient mind. It sees evil where none exists and by implication and innuendo distorts harmless incidents into deviations from right.

Gossip is no respecter of persons. Neither young nor old, high nor low are immune to its insidious virus. Even the most circumspect shrink from the tongue of gossip as a beaten animal shrinks from the lash. The threat of gossip induces real and justifiable fear. In so far as a gossip is suspicious of the probity and motives of others just so far are the probity and motives of the gossip to be suspected.

Growth

"Capacity for growth," and "ability to grow," are descriptive phrases sometimes included in the list of personal attributes used in rating employee efficiency. Such phrases should be explained or amplified and the sense in which they are to be understood not left entirely to the imagination. Certainly they do not mean mere "increase in bulk," as growth was once defined by a prominent zoologist. Any fair appraisal of capacity must differentiate spiritual, moral, intellectual and physical growth is desired.

A grain of corn may have capacity for growth, but a germination test alone will prove that it exists. Also an employee's capacity for growth may remain latent for lack of opportunity to unfold. If an employee is expected to develop his capacity or ability to grow, it is an administrative responsibility to provide the adjuncts and stimuli necessary to initiate and promote growth.

Human Resources

THE ULTIMATE objective of personnel administration is the maximum utilization of our human resources. Constructive plans and methods are fundamental to a careful and provident management and conservation of these resources. Progressive and enlightened personnel administration is based upon a theory of mutual interest in the welfare of the organization and of mutual interdependence of both employer and employee. man resources alone supply the material which vitalizes an organization. They may be increased, developed, or created. government, which is not organized to make money but to spend money, lacks the costaccounting yardstick that is used in industrial management to measure the value of an employee's services. An important personnel function, therefore, is to develop standards for evaluating the services of government employees and to devise and introduce such new and improved practices as will insure the highest type of public service and also maintain a correspondingly high employee morale.

In-Service Training

EFFECTIVE government must be responsive to the constantly occurring changes in economic and social conditions. Employees must have the opportunity to keep abreast of the progress of events which are related to the part they play in conducting the public business. Organized in-service training is a very promising means of increasing the ability of employees to meet the demands of government for a continuing growth in their competence. Although in-service training is nothing new in the government service, heretofore it has not been well organized.

Comprehensive programs of in-service training are now in the making. Ultimately the expenditure of necessary services and funds must be justified by the proponents of these programs. This will be difficult unless there has been (1) a critical, advance determination of the kind and quality of training that is most needed, (2) assurance that the training programs are educationally sound, and (3) a reliable method devised for evaluating the training.

Interest

Interest in the work one has to do may follow either of two directions. It may be centripetal, tending to focus sharply on a limited field; or it may be centrifugal, dispersing over a wide area. Centripetal interest, closely adhered to, leads to narrowness of mind and stifles curiosity about related fields of work. It induces indifference to opportunities for gaining information from all sources not immediately related to the subject of specific interest and eventually develops the type of individual styled "routineer."

Centrifugal interest normally leads to intellectual growth and broadness of vision since it includes exploration of the periphery of the subject as well as the center. It overlooks no opportunity for obtaining information however remote the source from the primary field of activity. Centrifugal interest counteracts the dangers of extreme specialization, develops wider perspectives and provides a more dependable background for sound and reliable judgments.

Introspection

"Know thyself," was urged by Socrates twenty-four centuries ago. He was an illustrious patron of the art of introspection or self-examination. Anyone can begin the practice of this art today, tomorrow. No preliminary courses of instruction are required. The only prerequisite is a sincere desire to understand and correctly evaluate the traits, attitudes and behavior which characterize the individual.

All too frequently failure to obtain desired recognition, promotion, preferment or social acceptance is ascribed to the prejudice, bias, discrimination, gross neglect of associates or official superiors or some other factor beyond the control of the individual. It is probable that the cause of the difficulties lies within himself. But he evades personal accountability for his failures and shifts the burden of responsibility to someone else.

Honest self-examination is likely to reveal certain inherent weaknesses which may be overcome by determined effort and so improve both mental attitude and human relationships.

Language

STICKING out the tongue, when done to express thought, is language. Oral and written words, signs, symbols, gestures and facial expressions are also means of communicating thought to others. No matter what medium is employed, imperfect transmission is likely to occur. Although words have the widest use, it is far from easy to select those which will give precise expression to thought. Even when found such words may not have the same meaning to different persons. In consequence a great deal of time and energy is often expended in fruitless argument or wordy battles which could be avoided by a preliminary definition of the terms to be used in the discussions.

When words are used as the vehicle for the conveyance of thought their effectiveness will be determined by the ability of the persons addressed to correctly interpret their meaning. A speaker who talks over the heads of his audience merely wastes his breath.

Loyalty

LOYALTY is a zealous devotion and faithfulness to country, to principle, to a superior, a person, or a group of persons. In all human relationships much importance is rightfully attached to loyalty. It is a test of friendship, of trustworthiness, of dependableness. Instilled in early youth, loyalty becomes an unconscious habit with maturity.

Since the human relationships of each person are many and diverse, each will necessarily have a correspondingly large number of different loyalties. In an organization there will be his loyalty to each superior and to each larger unit in the administrative line above him. Also there will be his loyalty to his community, school, church, societies, fellow workers, friends and family. To determine where, among all these, the deepest loyalty lies is a difficult problem. Extreme loyalty to one may easily result in some disloyalty to another. There is danger also of mistaking enthusiastic partisanship for loyalty.

Mental Activity

Some older persons have much more alert and active minds than others of equal age. They have the ability to recognize undesirable mental habits and the resolution to change them. Mental activity may merely go round and round in a circle, each revolution deepening the rut in which it travels, or it may follow a rising spiral of constantly increasing diameter.

There is cause for real concern if reflection discloses little or no change from year to year in the scope and character of one's reading and other mental diversions, or in his perspective of events both past and present. It is then advisable, periodically, to discard accustomed magazines for others entirely different in point of view; to choose books on subjects remote from those presented in the ones formerly read; and to give preference to those lectures, conferences, radio programs and movies that divert thought into previously unexplored fields.

Morale

Morale is an attitude or state of mind which is reflected in behavior or conduct with respect to enthusiasm, confidence, courage, hope, loyalty, zeal and analogous feelings. Morale is fundamentally important in successful administration. To the able executive the maintenance of high morale becomes an actuality, not a pious sentiment. The importance of morale is recognized both by the football coach who inspires his team to maximum effort by appeals to their pride and sportsmanship, and by leaders of aggressor nations who insidiously endeavor to undermine the morale of a neighboring people preliminary to invading and subjugating them.

Low morale, in general, is either an index of the degree of supervisory ability, or a symptom of untoward circumstances affecting the situation in which individuals are placed. Morale may be suddenly vitiated by some shock or blow to the sensibilities or it may slowly crumble from lack of stimulation.

Opportunity for Advancement

Among the factors which affect the opportunity for advancement within an organization is the relative number of positions at each level of authority or responsibility. Since the number of positions at each level is usually inversely proportional to their importance, the organization may be likened to a pyramid in which the number of positions rapidly decreases as the apex is approached.

In an organization of, for example, one thousand employees, it would be rather absurd to hold out the hope that each one of them would ultimately attain a position at or near the top. Practically and mathematically that would be an impossibility. Then why not frankly admit the futility of encouraging a hope of continuous advancement for every individual? It would be much fairer to face the situation squarely and to endeavor to develop appreciation of other satisfactions which may be derived from the work when advancement seems no longer possible.

Organization Charts

A HUMAN skeleton is not a pleasing object to behold; it suggests but very imperfectly the tissues and sinews with which it was once clothed. Although its utility is obvious, no one would contend that it adequately depicts the living body.

Likewise, the organization chart is merely a skeleton or framework which gives form to the activities and relationships of a group of persons working together toward a common It does not and cannot really objective. portray that great complex of human abilities, attitudes, responsibilities, and inter-relationships that make a living, vital organization. An organization, like a living organism, is everchanging; if change ceases, atrophy and disintegration ensue. Just as the benzene ring of the chemist symbolizes his conception of the arrangement of atoms in the molecule, so the organization chart merely symbolizes a conception of group relationships. It can never be more than an imperfect pattern of transitory conditions.

Perspective

How often have we been told that seeing is believing! Yet our own eyes are often gay deceivers. From the top of the Washington Monument automobiles in the streets appear as overgrown toys. Or a friend distant from us by the width of an athletic field may appear to be half normal size. But no one is deceived as to the actual size of automobiles or friend. By an unconscious mental process we correct our visual perspective for the effect of distance on the apparent size of an object.

Mental perspective also deceives at times unless allowance is made for distortion. A dime held close to the eye will obscure the sun. An individual's own line of work may loom so large in his mind's eye that he can see little importance or value in the work of others. But the application of reason and logic can correct his perspective.

Point of View

Some persons may regard another's task as a dull, depressing routine, lacking in interest and personal satisfactions. Similarly, they may feel or express commiseration for people who are isolated from the amenities and convenience of urban life or whose supply of material goods by comparison appears insufficient to satisfy the desires of normal living. Year after year, however, many persons find interest and enjoyment in purely repetitive tasks, and despite the limitations usually imposed by rural life there are few who would exchange it for the tyranny of things and affairs of the city.

Who among us is wise enough to say that another's occupation lacks attractiveness? A lens-grinder, a brick-layer, a farmer and a mountaineer basket-weaver doubtless find in their work a never-failing source of inspiration hidden from those without actual experience in these crafts. Not our own but the other fellow's point of view is of real importance.

Prestige

Persons who have won the respect, deference and approbation of their fellows, whose counsel is valued and whose advice is heeded, have acquired prestige. Perhaps without conscious recognition a desire for prestige is the driving force behind all efforts to excel or surpass others. But prestige is not attained merely by effort. The individual whose anxiety to gain prestige leads him to maintain an expensive automobile on a wheelbarrow income fools no one but himself.

Prestige develops entirely apart from and beyond the control of the individual. Brilliant work by an economist brings to him no prestige unless it becomes known to his colleagues and wins their commendation and approval. Publications and participation in conferences and meetings may acquaint others with his work. Their evaluation of its worth largely determines his future preferment and advancement. Prestige, therefore, derives from the esteem in which an individual is held by his associates.

Price of Preferment

MEN WHO RISE to positions of prominence and responsibility almost invariably have friends who are loyal and zealous and also enemies who are equally zealous in their hostility and antagonism. Having raised their heads above the dead level of mediocrity, they become targets for the barbed shafts of calumny and envy cast by the evily disposed among those who have been surpassed. Men in public life are particularly subject to these insidious attacks on their character and reputation, but there is no permanent escape even for those in comparative obscurity. Such is the price of honor and preferment.

All who may rise above any level of their fellow men must steel themselves against the pernicious chatter of malicious tongues. When firm in the belief that their motives and course of action would be upheld by impartial judges, they must refuse to be annoyed or disheartened by unmerited or disparaging criticism.

Promotions

AN ESSENTIAL element in any well-rounded program of personnel administration is a sound promotion policy. The prospect of promotion stimulates earnest effort, assiduous application and intelligent preparation for the assumption of additional responsibilities. Promotions are a necessity in the growth and development of an organization. The constant intake of new personnel at the lower levels of compensation and responsibility is counter-balanced by a continual outgo at the higher levels of responsibility. There must be frequent advancement to successively higher and higher positions if gaps in the ranks are to be avoided and key positions acceptably filled.

Promotions are neither special favors nor rewards for time serving. They recognize increasing competence and demonstrated ability to undertake and successfully discharge greater responsibilities. In his own self-interest, therefore, every employee should be impelled to utilize to the fullest extent available educational facilities to amplify his knowledge and widen his outlook.

Public Opinion

THE INCULCATION of a high sense of personal responsibility to the public at large is an important part of public personnel administration. The attainment of each and every objective of an organization is conditioned, but to a varying extent, by public opinion. Public sentiment for or against an organization is often built up from a series of impressions derived from association with a very limited number of its representatives. The low estimation in which public employees are held by many persons may be due to the indiscreet or ill-considered action or attitude of a small minority, yet the entire service is condemned as unworthy or inefficient. Thus the lapses of a few from high standards of conduct and demeanor bring much unmerited discredit to many. This situation will change only when employees are convinced that it is their responsibility to become a constructive influence in developing and improving public relations.

Release of Human Energy

The release of sustained and effective human energy and its diversion into channels of cooperative endeavor or productive work is one of the major objectives of organization. The agents of this release are psychological rather than material in nature. Thus fear, impending danger, or excitement engendered by a calamity or disaster, sometimes enables persons to perform almost superhuman feats of strength, but for very short intervals of time.

There are other agents of release of energy which awaken an orderly, enduring response that facilitates the progress of employees toward the fulfillment of their ambitions. Among these agents are loyalty and fidelity to the purpose of the organization; the aspiration to assume responsibility; pride of craftsmanship; craving for approbation or esteem of colleagues and associates; longing for admiration because of accomplishment; desire for prestige; and the urge, in times of national emergency or crisis, to render a maximum of needed service.

Respect for Work

THE ASSUMPTION that some kinds of work have greater virtue or are more worthy than others suggests an attitude of snobbish superiority or exclusiveness. The many different kinds of work required in a large and complicated organization are in principle equally meritorious. Employees who type manuscripts, file correspondence, or maintain records have no less opportunity in their own spheres for rendering creditable and praiseworthy service than those who manipulate the paraphernalia of the laboratory or engage in some specialized field activity. Unwarranted discrimination is often made between different kinds of service. Even social distinctions are sometimes based on diversity in character of work. Certainly, auditing an expense account is no less worthy than identifying fungi. And cataloging a book is no less deserving than efforts to get parity between industry and agriculture. Obviously all the different kinds of work needed in an organization are equally entitled to consideration and respect.

Sacred Cows

THE ANIMAL worship which is prevalent among certain peoples is abhorrent to the western mind; yet, in administration, there are objects of veneration that have attained the status of sacred cows. Among them are academic degrees, concerning which the president of Brown University recently said, "Degrees, as such, are only tinsel." They are symbols of learning and wisdom that do not reveal the extent to which the recipient of a degree is either learned or wise. Educational institutions vary widely in their relative standing, in their requirements of candidates for higher degrees, and in the quality and scope of the courses offered. Individuals who receive degrees are also unequal in capacity and ability. The degree itself, therefore, is not a hall-mark of uniform excellence and competency.

Votaries of the degree often are blind to the fact that there are men lacking this academic emblem who are distinguished for their attainments.

Thirty-nine

Sharp Practice

There are men who appear to regard themselves as discredited or lacking in administrative acumen if some of their recommendations fail of approval by an official superior. They attach greater importance to that approval than to the merit and soundness of their proposals. Deceived by a false measure of ability they are led to omit, conceal, or even misrepresent facts inimical to a favorable decision. Thus the interests of the organization are subordinated to the personal vanity or self-pride of the one who makes the recommendation.

Before reaching a decision the official superior is entitled to a full presentation of all the facts irrespective of their implication. He must not be misguided, by withholding pertinent information, into making decisions prejudicial to his responsibility. This is a sharp practice which springs from decadent loyalty and self-deceit. Such tactics are soon recognized and engender distrust of all proposals, both specious and authentic.

Short Circuits

SHORT CIRCUITING in administration, that is, going around or over the heads of line officers, greatly increases the difficulty of maintaining morale. This is one of the many pitfalls that frequently entrap the unwary or inexperienced person who has been suddenly elevated to an important managerial post in an organization. Short circuiting, although prompted by laudable intentions, on the one hand arouses resentment and on the other engenders a lack of respect for constituted authority. However, it may at times seem justified in cases of emergency, when similar directions or instructions are to be repeated at frequent intervals, or when satisfactory previous arrangements have been made with the intervening supervisor.

The reluctance of employees to go over the head of an immediate supervisor is well known. Many will endure in silence despite impaired morale, rather than seek redress from higher authority. Even non-electric short circuits impair the functioning of operating machinery.

A Spur to Effort

The relatively few positions at the higher levels of authority and responsibility are a constant challenge to ambitious employees who are striving to develop their capabilities and to prepare themselves for advancement when opportunity offers. These opportunities often exceed the actual positions in number, especially when changes in personnel occur in rapid succession. The resulting vacancies are usually filled by selecting from lower grades those who are prepared to undertake heavier responsibilities.

In general, positions decrease in number in inverse proportion to the ability required to discharge the obligations which they impose. On the other hand, the difficulty of discovering qualified persons who can satisfactorily fill the higher places increases in proportion to the importance of the position. The knowledge that there are attainable goals of achievement is one of the strongest incentives to further effort, consciously directed toward preparation for an enlarged and more active field of service.

Supervision

Supervision, an important element in administration, is often one of the weakest. From a mercenary point of view supervision is merely a means to secure the greatest possible output of effective work from employees within a given unit of time. From a more enlightened point of view supervision is leadership. It involves planning—to minimize the necessary oversight; organization—to facilitate and coordinate proper effort; instruction—to insure understanding of requisite processes and procedures; training—to develop skills and increase knowledge of methods; and direction—to guide conduct and behavior into right courses.

The hard-boiled supervisor who harshly berates his employees on the slightest provocation, who ignores their right to courteous and considerate treatment, and uses fear to drive them to their work, may honestly hold the erroneous opinion that his methods produce the most satisfactory results. But he is only burning incense on the altar of his own self-conceit.

The Standstill

The problem of the unprogressive employee must be squarely faced and solved. In every department short search will disclose a few employees who for long periods of time have made little or no advance either in compensation or in responsibility of duties. Fellow workers have continuously progressed to higher brackets while they were left behind. Eventually they become discouraged, unhappy or disgruntled.

Why do these cases occur? Were these employees deficient in training, assigned out of their aptitude, or improperly supervised? Were they victims of the accident of circumstance? It may now be too late to rehabilitate such cases if of long standing, but what excuse can be offered for permitting them to develop in the future? Unfitness or incompetence can be detected in the probationary period and permanent appointment denied. In existing cases the supervisors concerned have an obligation to reappraise the employee's difficulties and if possible relieve them.

They Jook It for Granted

ONCE a high official of the Department, to reward a deserving employee, assigned him to a responsible administrative position. The official assumed that the employee had administrative ability. But he did not. Mismanagement finally caused his discharge from the service, ruined his career.

A research chemist published his discovery of a previously unknown compound in a certain plant. Later, another chemist proved that the plant in question belonged to an entirely different genus. The first chemist had assumed, without first making sure, that his material was correctly identified.

An elevator operator voiced an opinion to a friend who expressed disagreement by saying "You're crazy." He was overheard by a person who started the groundless rumor that the operator was insane. Soon the occupants of an eight-story building were using the stairs because they feared the operator.

It is better to be certain than to take too much for granted.

Tolerance

Tolerance, one of the virtues of democracy, is closely related to several other virtues among which are forbearance, sympathy, understanding, reason, justice and freedom. He who is tolerant exercises forbearance when passing judgment upon the opinions or acts of others. His sympathetic understanding leads to recognition of the right of the private individual to follow his own convictions if he does not invade the rights of others or transgress established bounds. Reason governs his attitude towards religious or political beliefs different than his own. His sense of justice makes of him an ardent supporter of the cause of human freedom.

There is a sharp distinction between tolerance and a mere indifference. The one is positive, the other is negative. Tolerance affords protection for the exercise of the moral and spiritual elements in social behavior. Indifference manifests no concern for either.

Tradition

ALL OF Us are indebted to tradition from which we have derived much that we know and most of what we have learned. Tradition is the refined wisdom of the ages vitalized by the personal experiences of our forebears, transmitted from generation to generation. Ultimately there results a cultural pattern which molds our beliefs, customs, attitudes and behavior. A comparison of many cultural patterns will show similarity and also unlikeness. Dissimilarities arise from variations in the events or experiences out of which the cultural patterns were formed.

People today are not more intelligent than their ancestors. They do know more because they have added to the store of knowledge already acquired by those ancestors. Their progress is greatest when they avoid repeating the errors of their predecessors. We can pay at least a part of our debt to tradition by making sure it is not lost to the rising generation.

Uncivil Civil Servants

CIVIL SERVANTS may well ponder the lack of respect that many citizens have for the government service. Civil servants themselves have been largely responsible for this adverse public sentiment. Many years ago, it is said, employees in one of the Executive Departments were notified that they would not be paid unless they were at their desks at least one day each week. Since then observance of working hours has become the rule, but many citizens still do not receive the courteous and considerate service to which they are entitled.

Civil servants should realize their responsibilities to their employer, the public, for wherever they are, in the eyes of the public they represent the entire branch of the government of which they are a part. If the citizenry do not hold their services in high esteem, the cause as well as the remedy lies within the body of civil servants themselves.

Unity of Organizations

The structure of every organization, irrespective of its functions or objectives, is erected upon the primary assumption that a few will command and the many will obey. The localization of final authority and power at the top level of the structure determines its hierarchical form and establishes the organization as an autocracy in fact. The exercise of power within the ambit of the hierarchy is autocratic or democratic, despotic or benevolent according to the character of the high command.

All organizations, whatever their field of operation, have certain features in common. Each one is a group of human individuals banded together for the accomplishment of some definite purpose. The interplay of the various attitudes and abilities, hopes and fears, likes and dislikes of these individuals produces patterns of relationship which, like threads of distinctive color in a variegated fabric, run through the entire network of organizations in a social structure.

Voluntary Cooperation

Voluntary cooperation means nothing to the dictator; he enforces involuntary compliance. Voluntary cooperation means much to the skilled administrator; he develops it by ethical methods. Cooperation means joint action, mutuality of interest. It implies participation as equals, willingness to compromise, readiness to make concessions for reciprocal advantage. Cooperation and compulsion are mutually exclusive and antagonistic. Compulsion suppresses freedom of expression, inhibits voluntary response, arouses hostility and secret opposition.

Enlightened methods of directing human effort are relegating compulsion to the limbo of the outmoded and obsolescent together with its consequent passive resistance, superficial compliance and grudging obedience. Patience and persuasion, rather than pugnacity and parade of power, are gaining wider recognition as more effective agents in promoting better individual morale, improved performance and greater esprit de corps. Cooperation, consistently practiced, enables an administrator to project his plans and policies throughout his entire organization and insure for them acceptance and loyal support.

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V

LEADERSHIP

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WARNER W. STOCKBERGER

I

How do administrative agencies actually begin to carry out a program? Equipped with a mass of knowledge gathered by the experts, dedicated to a certain purpose by its creators, and committed to a general policy by the choice of the executive, the organization cannot bring order into all the demands upon it without having able leadership. Administrative leadership is the guiding influence which shapes the progress of an agency or organization toward the attainment of desirable goals. In so doing it cannot be unmindful of public opinion and legislative directions; it must be ever alert to the implications of social responsibility. Through appropriate incentives, it secures a maximum of service; it conserves material and human resources; and it inspires high morale.

Since there is wide variation in the attitude of leaders in their approach to the human-relation aspects of public administration, a distinction may be made between authoritative leadership and democratic leadership.

The authoritative type of administrative leadership achieves its fully developed form in military organizations. It rests primarily upon authority and power—authority to issue



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commands and the power to enforce them. Compliance under this type of leadership is a matter of necessity and does not imply that there is either conviction or voluntary cooperation on the part of those who obey the commands. A sharp class division is maintained between the officers and the common soldiers, together with other symbols designed to emphasize the dominion of power and the superiority of the leader for those exigencies with which the military organization is designed to cope.

It is clear that these notions cannot readily be transferred into the ambit of public and private management. Individuals who have attained positions of leadership in civilian enterprises or organizations but whose attitudes are conditioned by the authoritative point of view are liable to allow their own interests and emotional impulses to predominate in all their official relations. It cannot be denied that brisk command yields results, but so did Pharaoh's taskmasters in the building of the pyramids. Time was when strong lungs and powerful fists coupled with the ability and will to use them were regarded as essential parts of the equipment for leadership. Today, instead of physical force, authoritarian leaders prefer to use fear to drive subordinates to their work—fear of humiliation or degradation in the presence of fellow workers; or fear of reprisals such as loss of favor, loss of opportunity for advancement, or even loss of status.

H

The democratic type of administrative leadership is a way of living and working in cooperation with human beings who think and feel. To the initiated there is nothing mystical or esoteric about such leadership. It is essentially the intelligent application of the rich fund of knowledge which has been ac-



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cumulated concerning human behavior and the systematic development of those traits or characteristics, discoverable by observation and reasoning, which form the basis for concerted effort in various fields of endeavor. However, a serious obstacle to the achievement of democratic leadership is presented by the traditional hierarchy through which administrative organization is effected. The persistent odor of autocracy is difficult to eliminate from a structure based primarily upon prestige and power.

The autocratic mode is so deeply ingrained in large-scale organization that it is not uncommon for those who prate loudest of democratic leadership to fail in the practice of what they preach. The cloak of democracy, worn becomingly when dealing with equals, is all too readily discarded for another garb when dealing with representatives of the lower levels of authority or responsibility. But progress is being made toward a better recognition of the full meaning of administrative leadership. The way in which this leadership is attained is of far less importance than the manner in which its potentialities are used and the ends toward which it is directed.

Administrative leadership is democratic only when and so far as it provides and maintains opportunity for the exercise of individual initiative, subject merely to those disciplines and restraints which must be imposed if freedom of selfdevelopment is to be preserved.

Ш

The area of administrative responsibility may be viewed as two concentric circles, the one including all those elements of responsibility appertaining to the administration or management of the internal affairs of an organization, the other including those phases of administration concerned with politi-



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cal, social, and economic relationships which are external to the organization. Although the latter field has not lacked careful exploration, we still experience no little difficulty in threading the maze of indefinite or inadequately defined relationships, sometimes obscured by vague or even inconsistent pronouncements of courts and legislatures. There is abundant factual evidence to account for the shadowy character of administrative responsibility in the field which is external to the organization.¹

Administrative responsibility in the internal area may be stated in general terms as the obligation or duty to plan, organize, coordinate, and control the means through which the ends of the organization may be most effectively attained.

A phase of administrative leadership of primary importance is planning. To some, this function appears to include practically the whole field of administration; but despite its significance, planning is only one phase of the administrative process. Obviously, there can be no administration worthy of the name which is not carried out according to a preconceived plan. There is a wide difference in scope and content between the detailed planning of methods and procedures in administrative operations and the broad general planning which is preliminary to the final choice of objectives and the formulation of policy. It is clear that when several agencies are directly concerned with the same general policy, cooperative planning is essential if diversity of functional interests is to be integrated into a mutually acceptable program. The active and sympathetic support of those who bear the responsibility for the execution of the program will be proportional to the declining curve of participation in the formulation of the plans.

¹ See the closing chapter of this volume and the literature cited in it.



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The United States Department of Agriculture affords a striking example of well-directed effort to secure effective participation in the development of plans for localized public agricultural programs. These include crop adjustment, crop insurance, soil conservation, flood control, farm forestry, development of submarginal lands and wildlife conservation. The Association of Land-Grant Colleges and Universities is working with the department in establishing democratic, cooperative procedures that will give farmers a voice in the planning stage. Community, county, and state groups are forming for this purpose. The state and local land-use planning will finally be integrated with the general planning and program-formation of the department.²

A second incidence of administrative leadership is the devising of organization, the distribution of functions properly related to each other and to the central purpose, and the formation of the resulting work groups into a concordant whole. We may conceive an organization as a social organism composed of various groups based upon personal interest or upon the type of task performed, such as management groups, professional groups, clerical groups, and the like. The recognition of the existence of these groups and the enlistment of their cooperation is a cardinal problem of management.

There is a logical sequence of steps in conceiving and putting into operation a new organization. Some of those who suddenly find themselves charged with the administrative responsibility for staffing newly formed or hurriedly expanded agencies fail to see that planning the organization and determining the duties and responsibilities of positions should precede instead of follow the employment of large numbers

² Henry A. Wallace, Report of the Secretary of Agriculture, 1938, pp. 47-49. ³ J. W. Dietz, "Organizing the Personnel Function of Management," Personnel Papers, 7th International Management Congress, 1938, pp. 3 ff.

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of workers. When this is not recognized, waste, delay, and confusion are inevitable. Among the new personnel, many will be found lacking in experience or ability for the satisfactory performance of the duties to which they have been assigned. The work then falls behind and more workers are employed until the force becomes far larger than would be necessary had the operations been planned in advance and selection made of only those experienced in the work to be done.

A belief appears to be widespread that new government agencies will be best managed and operated by a staff recruited from outside the public service. This may be true with respect to the formulation and enforcement of novel or unusual policies, but it has not proved true for the complicated and involved processes of operation. What is being overlooked is (1) that employees in the older services are just as eager as fresh recruits for the success of the new agency; (2) that because of their background and experience the employees in an established organization are more capable than new employees to set a nascent organization in motion within a minimum of time; and (3) that in general employees in an old organization are more competent than new employees to handle the work of a novel service, despite any advanced techniques which new employees are believed to have mastered.

A third responsibility of leadership is coordination—the interrelating of the various parts and elements of the work and the integrating and harmonizing of divergent views, experiences, and judgments into a unified working program. The fourth administrative responsibility is that of control. It seems almost instinctive to look upon control as a restraint or coercion imposed by higher authority or superior power. But



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this point of view posing a man-over-man relationship is being gradually supplanted by the impersonal concept of control emanating from the interplay of factors which constitute "the total situation." It does not suffice merely to bring together all the conditions pertaining to a given situation. Their reciprocal relationships must be explored, then integrated, if effective control is to become a reality.

Take as an example the Dust Bowl area where drought and winds have deprived the farmer of his primary resource for subsistence, the soil. One agency urges farmers to seed the land to grass as a protective measure against soil erosion. Another agency offers loans to the same farmers for the purchase of seed wheat. Land seeded to grass will not produce bread, but if planted to wheat the wind would continue to remove the soil. If similar antinomies are to be obviated in future, all agencies at interest in a given situation must seek through cooperation to discover the relationship of all the facts in the situation as an entirety in order to gain the basis of control.

IV

Some have taken the view that one great weakness of government today is a lack of administrative brains and an inability to delegate responsibility. The remedy suggested is more intensive training in administration as a means of developing the needed increment in intellectual power since such training might result in increased ability to delegate responsibility. The delegation of responsibility has long been practiced by capable administrators. The act of delegation, however, merely *entrusts* a certain responsibility to another as agent and does not absolve or relieve the principal from his primary obligation or the agent from responsibility to his



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principal. Responsibility, when delegated, should be commensurate with the ability of the agent to discharge it with judgment and discrimination and to recognize the inherent limitation of his freedom of action.

There is no doubt that delegation of responsibility requires commensurate allocation of authority, but the application of this principle is full of difficulty. As an example, consider a highly decentralized or regionalized service whose chief has delegated a large measure of responsibility to an official in charge of a region. Owing to the remoteness of the region the official's contacts with the chief are infrequent, but he is in constant contact with public officials, pressure groups and individuals whose interests are localized in the region. Conditioned by these local forces, he gradually assumes the attitude of a special representative of the region and as such may disregard or even oppose the general policies of the central chief to whom he is administratively responsible. The chief may discipline the regional officer by transfer or dismissal, but in so doing he is certain to arouse formidable political opposition, especially if a number of states are included in the region. Thus, unrestricted delegation of responsibility may weaken central administrative authority.

v

Leadership and responsibility are functions of administration the exercise of which devolves primarily upon the executive head of an organization and secondarily upon his subordinates who occupy key positions at each successive level of authority. The range of action, limited at the lower levels, progressively increases as the scale is ascended and reaches its maximum at the higher levels. Experience gained and ability demonstrated at the lower levels lead naturally to



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advancement with accompanying increase in the scope and importance of activity.

A wise and farseeing high command will recognize that the accomplishment of the objectives of an organization is largely conditioned by the extent to which potential leaders have been selected and trained in leadership and the extent to which opportunity has been provided for them to gain experience in assuming and discharging administrative responsibility. There must be mobility and impetus toward self-probation throughout the entire structure of the public service in order to give administrative leadership a sounding board, but also to make it a self-perpetuating process. As Ordway Tead so aptly put it:⁴

In a profound sense people in following the sound leader are following their own best selves. This is but another way of saying that the expansion of personality which the leader helps his followers to achieve coincides with their central demand upon life itself. That oneness which he achieves with them at a new level of aspiration and action is the justification of leadership in a democracy. For a democracy is nothing if it is not a spiritual fact—a fact of fruitful personal relation to the community. And the intermediary in helping to bring that relation into being is the leader—or rather a whole supporting gallery of leaders.

⁴ The Art of Leadership, 1935, pp. 270-271. By permission of the publishers, Whittlesey House (McGraw-Hill), New York.



(1)

The Need for Career Administrators

By W. W. STOCKBERGER

AMERICAN democracy will survive only as long as it remains responsive to the will of the people and is careful and provident in the management of the business of their government. The huge and complicated administrative machinery of government must continue to operate economically and efficiently under any and every policy determined upon by the duly elected representatives of the citizenry.

DISTINCTION BETWEEN GOVERNMENTAL FUNCTIONS

In any consideration of the machinery of government it is useful always to keep in mind a clear and sharp distinction between the policy-forming function and the administrative or management function. Policy formation is primarily a function of the political or elected officials of the government. Administration is or should be a nonpolitical function, concerned with the effective direction and purposeful improvement of the established and continuous operations of the business of government.

Thus, whether the presses in the Bureau of Printing and Engraving should print an issue of greenbacks or other fiat money is a political question to be answered by the policy-forming officials; but the actual printing of the money is a purely nonpolitical matter, one of administration, a printer's job. Likewise, the decision that the government should open the Panama Canal was a political one, since grave questions of national policy were involved; but the actual work of bringing the canal to completion was a nonpolitical, administrative task for an engineer thoroughly conversant with a technical

specialty and having the ability to administer all phases of the undertaking.

A fuller appreciation on the part of the general public of the responsibilities of the political, policy-forming official on the one hand, and of the responsibilities of the administrative official on the other, should lead to a clearer understanding of the kind of service each renders to the public at large. Periodically the convictions of the electorate at the moment as to desirable public aims or ends to be attained find expression in the election of political officials as their representatives in the several branches of the government. A change in political officials may be and usually is followed by substantial changes in policy; but the machinery of government does not change correspondingly, but continues to operate with such adjustments as may be necessary to adapt it to whatever changes in policy may be determined upon by the newly clected officials of the dominant party.

Because of the failure to recognize this principle, the public generally looks upon the administration of government as a political matter. Consequently administrative positions in the government have been filled by men because they belonged to some influential political group, and not on account of their capability to render effective public service.

There is the failure also to appreciate the extent to which the business of government has become complicated and highly specialized as compared with the requirements necessary for the proper administration of government a hundred or more years ago. Since then the operations of government have been gradually extended into new



and broader fields of activity, until at the present time the administration of government is easily the largest and most complicated business in the whole of our country. It is not only the largest business, but it is also the most varied in number and kind of activities in which it is engaged. In fact it will be found difficult to name a legitimate activity which does not form a normal part of the operations of some branch of the government. Moreover, there are certain activities in which no one outside of the government is engaged.

NEED FOR SPECIALIZED TRAINING

For the accomplishment of the purposes for which its varied activities were established, the government requires the services of many persons thoroughly trained in some one of many specialized fields, such, for example, as the law, medicine, banking, economics, engineering, journalism, sociology, the physical and the biological sciences; and likewise it has need for many persons who have the breadth of training and the background of experience requisite to the successful administration of these activities. In order to attract to and retain in the service of the government a fair share of those persons who have the ability and specialized training essential to its needs, adequate provision must be made for security of tenure, a reasonable compensation, and opportunity for promotion to positions of higher administrative responsibility-in short, opportunity for a career.

Under our form of government, with its long established modes of procedure and traditional forms of administrative organization, it is unlikely that the American people would tolerate the establishment of an administrative career service comparable to that which obtains in the British civil service. Well-considered opinion inclines rather

toward specialization in administratic analogous to that which is found in the arts and sciences. Within the comple of activities pursued by the government, several categories of administration may be distinguished. There is an administration of legislative en actments, an administration of scientific research, an administration of fiscal affairs, an administration of public welfare, and many others, each of which affords an opportunity for the career administrator.

However, specialized training alone in the law or the sciences, for example, is an inadequate foundation upon which to build an administrative career in these fields. Administration, although not separate and apart from the activity administered, involves a scries of relationships not inherent in what is to be administered, but superimposed upon it. The understanding of the nature of these relationships and of the art of utilizing them effectively will be facilitated by a mastery of the principles of public administration and an exploration of the content of the social sciences. If government is to secure for the public service recruits who have the capacity to become satisfactory administrators, our educational institutions must be induced to afford selected students an opportunity to acquire a perspective of the relations of governmental operations to the public interest much broader than that usually developed in the standardized technical courses.

NECESSITY FOR EXPERIENCE

Overemphasized education in theoretical public administration, however, may create in the mind of the student the impression that he is fitted to enter at once into the public service at the higher levels of authority, without first serving that apprenticeship in practical administration essential to acquiring



the necessary seasoning and discipline which results only from long experience. The mastery of administrative procedure, whether in private enterprise or in some branch of the public service, cannot be attained until there is a comprehensive understanding of the interrelations of the several units within the organization, and of the primary objectives of each.

No organization reaches its maximum of effectiveness except through long years of development during which functions have been highly coordinated and the less important phases of administration so standardized as to become almost a matter of smoothly running routine. The administrative pattern varies with the type of organization and the character of its activities. Indeed, two organizations may superficially appear to have the same administrative pattern, yet differ fundamentally in the nature of their respective operations and in the limiting factors which govern in each case. Again, different patterns of administration may occur within the same organization; as, for example, in one of the large executive departments of the government there is administration of research, of extension work, of regulatory work, of legal work, of personnel, and of fiseal affairs.

Except as an abstract concept, administration does not exist apart from what is to be administered, as previously stated. As long as it remains an abstraction it can produce no tangible results; but when translated into human activity wisely directed and effectively managed, it becomes the determining factor in the accomplishment of the purpose for which an organization exists. There seems to be no escape from the conclusion that a far greater chance for a successful career lies with the administrator who has attained a high degree of profi-

ciency in the art of administration with which to supplement his specialized knowledge of the materials and techniques of the field to be administered.

RECRUITMENT OF ADMINISTRATORS

Frequently the ability to excel in some specialized field of knowledge does not occur in combination with outstanding administrative ability; consequently the staff of an organization engaged in specialized activities may not yield an adequate supply of human material from which capable career administrators can be developed. In this respect the situation in the government service has been particularly aeute during recent years, necessitating special consideration of the methods through which the services of capable administrators may be seeured and retained.

One method which has numerous sineere proponents is to bring into the service experienced administrators from non-governmental fields of activity. Some of the advantages said to be gained through this method of selection are: (1) that it obviates the delay incident to the long period of training necessary for the development of administrators within the service; (2) that it eliminates the uncertainty as to the outcome that obtains when a position of large responsibilities is filled by promotion from one of lesser responsibilities; (3) that it aets as an effective stimulus to the organization through the introduction of desirable "new blood"; (4) that it serves to counteract the tendency, usually more pronounced in the older organizations, to operate in accordance with the established though antiquated routine; and (5) that it brings into an organization the results of experience gained in other, different, and possibly more highly developed fields of administration.

But it is not to be overlooked that



the complexities of the machinery of government, particularly at the higher levels of authority, call for a corresponding high degree of competence, a rich background of experience, and zeal for the public welfare. In the face of these complexities, unfamiliarity with the methods of setting the machinery of government into motion either delays or prevents the accomplishment of desired results. Not infrequently a new incumbent of a high administrative position finds himself embarrassed by the necessity of calling upon more experienced subordinates, familiar with the technique of procedure, to instruct him in the methods to be followed if hopeless entanglements are to be avoided and looked-for ends attained. As a result, the higher official suffers a loss in prestige and in the respect of his subordinates, in whom there is developed a sense of injustice and discriminatory treatment which reacts against the effectiveness of the service.

Also, when positions at the higher levels of authority are filled by new incumbents drawn from outside the service instead of by promotion from within, one of the strongest incentives to sustained and productive effort is removed from the entire group of employees in the lines of promotion leading to the position in question. Such action is highly prejudicial to the idea of a career service, and can be fully justified only when no individual qualified to fill the higher position can be found within the ranks of the organization.

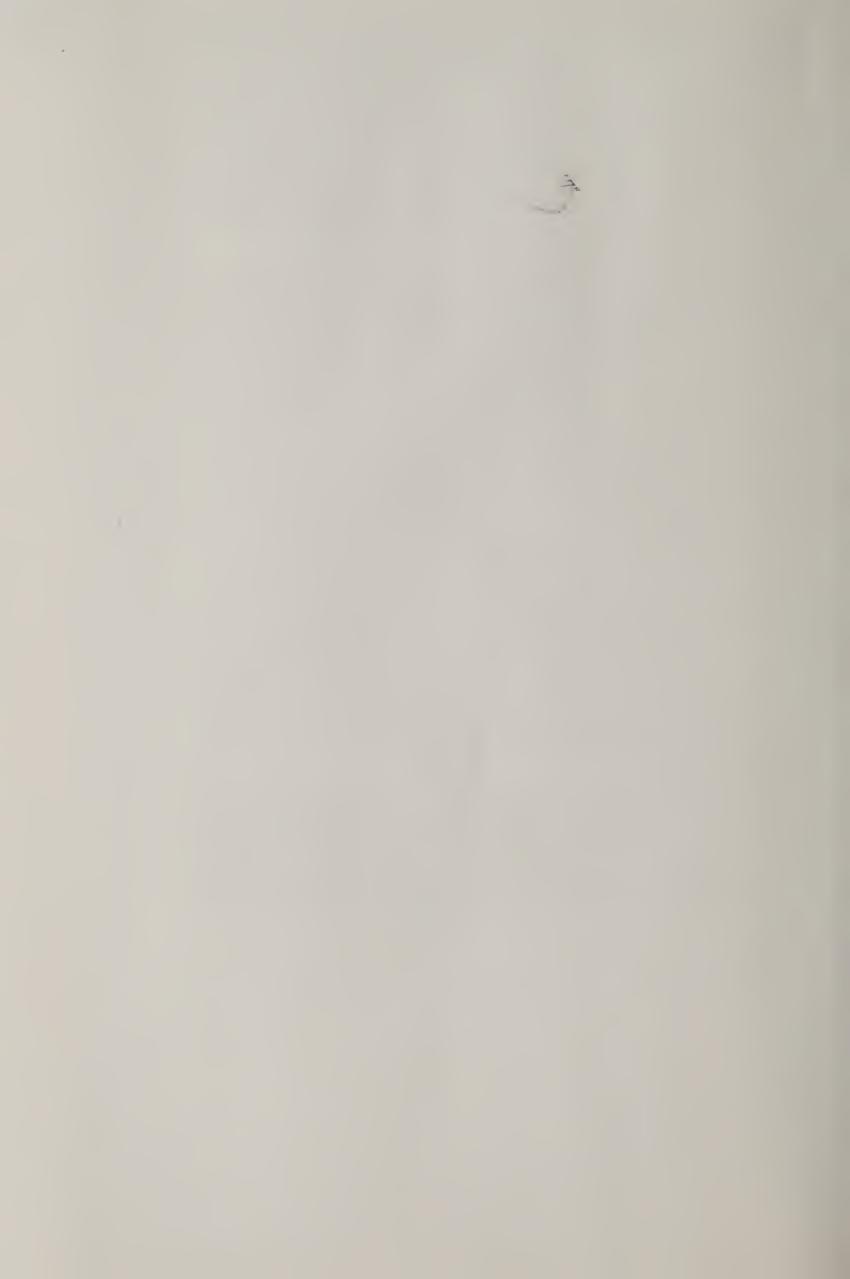
Since very cogent reasons can be advanced both for and against infiltration of the public service with administrators from non-governmental fields, there seems to be no escape from the conclusion that any advance and exclusive decision which does not recognize contingencies is a potential

danger to the welfare of the organization. However important it may be to foster career service in an organization and to protect it against encroachment from the outside, it cannot be permitted to preclude building into the organization the best material available for the accomplishment of the ends for which the organization was established.

Viewpoint of Nongovernmental Administrators

At this point it may be well to consider more in detail the reasons for the ineptness displayed by some new incumbents of positions at the higher levels of authority. Individuals who have attained to high rank and authority in the commercial or industrial world are not, as individuals, essentially unlike those in positions of corresponding rank in the public service. In general they are actuated by similar motives and ambitions, exhibit similar peculiarities and perversities of character, and respond in much the same manner both to leadership and to the lack of leadership. Yet the administrator who enters the public service from a non-governmental field may find adjustment to and assimilation into the organization seriously retarded, to say the least, both by his conception of the effectiveness of the procedures followed or of the efficiency with which the work of government is accomplished, and by his unfamiliarity with the objectives of the organization and the requirements of law upon which much of procedure is necessarily based.

The widespread lack of understanding of government organization and operation, augmented by the sarcasm, vilification, and ridicule often directed at the personnel in the public service as a means of currying favor with some portion of the citizenry, or for the purpose of obstructing the adminis-



tration of some measure designed to protect the public against fraud or misrepresentation but which interferes with the pursuit of private ends inimical to the public interest, often leads to the assumption that the performance of public business would be facilitated to a great degree by elimination of supposedly useless "red tape" and the substitution therefor of likewise supposedly superior and more expeditious procedures of other large organizations. keen but not unfriendly critic has pertinently expressed this point of view in the statement that in private enterprise there are always methods of operation, but in government it is red tape.

The administrator from the outside who, without thorough exploration of the basis of existing procedures, attempts to speed up action by taking "short cuts," or who is unwilling or anable to subordinate his freedom of individual action to the common purpose which motivates the interaction of human relationships within an organization, may readily come to be regarded as a liability instead of an asset.

Necessary as it becomes at times to fill a vacant administrative position from some source outside the service, the uncertainties attendant upon this method of selection weigh heavily against any advantages which it has to offer. On the contrary, a firmly established career service would make possible the development within the organization of a group of employees trained in the successive phases of administration and offering a wide range of choice in the selection for assignment to a specific vacancy.

TRAINING OF ADMINISTRATORS

The problem of training administrators within the government service is one of grave concern, for which there

is as yet no generally accepted solution. The use of the "understudy" is perhaps the most common method of fitting an individual employee for advancement in the administrative line. He is expected to gain in wisdom and understanding through close association with an official of higher rank, and through the performance of such assignments as may be intrusted to him.

The effectiveness of this method of training may be open to question. It lacks the element of careful planning essential to any systematic course of instruction. There is danger also that the understudy may not differentiate the weak from the strong in the administrative methods of his superior, with resultant imperfections in his own standards of attainment. Again, the understudy has a restricted opportunity, particularly at the lower levels of authority, to gain a comprehensive view of the field of administration which lies outside the working unit to which he is attached.

A earefully planned program for the development of administrators through the use of "trainees" offers ecrtain advantages over the understudy method of training. From among the possible candidates for placement in the service as trainees, scleetion should be made only of those who have special qualifications and whose personal intérests indicate an inclination or aptitude for administration. Through a series of special assignments the trainees are familiarized with all phases of administrative work in one unit of the organization, and are then successively transferred from unit to unit until finally they have mastered the procedures of all and have acquired a general perspective of the relations of any one unit to each of the others and to the organization as a whole. At this point selection may be made of the most promising of the trainees for



assignment in the general administrative offices of the organization where eventually they may be permanently placed in positions of large

responsibility.

Another possibility of effecting improvement which must not be overlooked, particularly in the older branches of the service, lies in the training of line administrators who, because of long tenure at definite levels of authority, have developed irregular habit patterns in their methods, or who, through lack of opportunity or of incentive have failed to keep abreast of recent progress in the field of administration.

The appropriate method to be used in the training of line administrators must be determined in each case after consideration of the attendant circumstances. A method which yields satisfactory results at one of the lower levels of responsibility may prove to be useless at a higher level. In one plan which has proved to be quite satisfactory, various methods were arranged in an ascending series corresponding to the several levels of responsibility, beginning with short, intensive study courses and ranging upward through

formal study courses, group conferences, and discussion groups to informal lectures by outstanding authorities on broad questions of management and general policy.

RESULTS OF CAREER TRAINING

The results of placing the training of administrators on a career basis are obvious. The prospect of a permanent career would increase the prestige of the service and attract to it a larger share of the ability and competence which the country affords. Career training points directly to lines of promotion, and promotion determines growth and progress. It is the sap of the organization tree.

Career training should raise the standard of administration to a parity with the responsibilities of the service; develop a group of potential administrators broad of outlook and capable of undertaking new and difficult responsibilities; cause the entire personnel of the service to become more "administration minded"; improve the quality and effectiveness of line supervision; and firmly establish administration in the public service on a plane commensurate with the public interest.

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PART II. AGRICULTURE

THE PERSONNEL PROBLEM IN THE UNITED STATES DEPARTMENT OF AGRICULTURE

W. W. STOCKBERGER

Director of Personnel and Business Administration, United States

Department of Agriculture

PROFESSIONAL POSITIONS IN THE DEPARTMENT

The Department of Agriculture, created by Congress in 1862, was provided in that year with an appropriation of \$64,000 and directed to acquire and diffuse useful information on subjects connected with agriculture in the most general and comprehensive sense of the term. Year by year the scope of the department's activities has extended beyond the work of collecting and issuing agricultural information, until now it covers a very broad and complex field.

The work of the department touches every phase of agriculture and many related problems as well. "This work deals with the selection and breeding of superior plants, the development of new varieties, and the biology of plant diseases. It studies how to increase the weight of the beef animal and the milk production of the dairy cow. It ascertains facts about the nutritive value of feeds. It investigates problems of soil composition and fertilizer requirements. It develops poisons, insecticides, and serums for use in the war against pests and parasites. It goes into the economic problems of the farmer, into his social and community problems, into his transportation problems, into his problems as a consumer. It studies wild life, so that beneficial species may be protected and conserved or reared under domestication and harmful species controlled. It deals with engineering problems, such as those connected with irrigation, with the prevention of soil erosion, with highway construction, and with the efficient use of farm machinery.

"It embraces also problems of importance to the home maker, such as those connected with diet, cooking, clothing, house equipment, and the expenditure of the family income. It carries on work



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in industrial chemistry, to promote an increased utilization of farm products and farm by-products. It inquires into the purity and healthfulness of food and drugs offered for sale in interstate commerce. It studies the weather, for the protection of a thousand agricultural and industrial interests. All the main branches of science, particularly chemistry, biology, and physics, are represented in the department's research activities."

Before the creation of the Department of Agriculture a small staff in the Patent Office was engaged in such work in agriculture as was then sponsored by the federal government. The subsequent growth of the department as reflected by the increase in personnel is shown in the following statement:

Year	Number of Employees
1861	9
1871	\$ ‡
1881	101
1891	1.577
1901	3,388
1911	12.704
1921	18.748
1931	27,615

It is said that in 1866 the entire scientific staff of the department comprised only ten individuals. In 1931 the number of professional positions in the department, so defined in the terms of the Classification Act of 1923, was 5346. The distribution of these positions by salary groups is given in Table 1.

The department is now composed of twenty principal administrative units, designated bureaus or offices. The number of professional positions in these units varies widely in part because of the variation in size and in part because of differences in the nature of the activity with which an individual bureau or office is concerned. The distribution of professional positions by bureaus and salary groups appears in Table 2.

The professional positions in the department may be divided

M. S. Esenhewer and A. P. Chew, Th. United States Insurface to A. Assistant like transith, Networker and Functions (USDA, Mic. Pub. No. 88, 1091), p. 1.

*Professional in the sense that they have been classified in the Professional Services by the United States Personnel Classification Board. Employees who had a cade a degrees for who are classified in the Clerical, Administrative and Fiscal Services in the included in this discussion.



PERSONNEL IN AGRICULTURE

TABLE 1

NUMBER OF PROFESSIONAL POSITIONS IN EACH GRADE AND SALARY GROUP OF THE DEPARTMENTAL AND FIELD SERVICES OF THE U. S. DEPARTMENT OF AGRICULTURE.

GRADE			O. VI OF AGR	TO CELURE
	SALARY GROUP	DEPARTMENTAL	FIELD	TOTAL
Junior, P-1	\$2000 \$2600	164	1099	1263
Assistant, P-2 Associate, P-3 Rall Collaboration	2000 3200	552	1612	1837
Full Grade, P.4	3500 4600	570	693	982
Senior, P-5	. 4600- 5100	153	247	370
Principal, P-6	5600- 6100	294 128	365	659
Head. 1'-7	6500= 7500	13	7.5	203
	S000= 9000	1.7	9 3	15
Total				17
* The data in this		1520	4096	5346

The data in this and the following tables were compiled as of April, 1931.

roughly into six occupational groups. The distribution of these groups by bureaus is shown in Table 3. It will be noted that the largest number of positions, 3054, falls within the agricultural, biological, and physical science group, and the second largest number, 1330, in the veterinary science group. The medical science group has the smallest number of positions.

The positions dealt with in this paper occur under general class titles. For convenience in tabulating the data, the term "class" is here used to include all positions having the same generic designation, as chemist, agronomist, entomologist. If, in Table 4, the grade designations, "junior," "assistant," etc., are substituted for the symbols P-1, P-2, etc., there will become evident the individual classes in the sense in which this term is used by the United States Personnel Classification Board. Inspection of Table 4 reveals that certain classes contain a much larger number of positions than others. The twenty classes of highest rank numerically contain 4343 positions or 81.2 per cent of the total number. Consider now the distribution by bureaus of the positions in these twenty principal classes. From Table 5 it appears that with the exception of chemists no one of these twenty classes is represented in more than five bureaus. Again with the exception of chemists, a large proportion, and in seven cases all, of the positions in each class are restricted to a single bureau. This is a normal result of the specialized activities of the several bureaus and accounts for the small uninber of professional employees who transfer from one bureau to another.



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NUMBER OF PROFESSIONAL POSITIONS BY BUREAUS IN EACH CLASSIFICATION GRADE OF THE DEPARTMENTAL AND FIELD SERVICES TABLE 2

The same state of the same sta		DE	PART	HENT!	DEPARTMENTAL SERVIC	WICE						FIELD	FIELD SERVICE	CE		1	TOTAL
BUREAU	P-1	P-5	P-3	P-4	P.5.	D-6	P-7	l s-d	P-1	P-2	7-3	1-4	P-5	P-6	P-7	P-8	
	10	080	98	10	57	C	G	-	96	200	30	91	25	ઝ	:	:	923
Vgricultural Economics	<u>-</u>	. T	2	2 -	3	,	, —		13	27	13	13	10	_		:	\overline{x}
Agricultural Engineering	- 0	- t-	- 0	- =	3.5	: 0	_	-	566	90.5	133	17	30	_	•	:	1143
Animal Industry	n 46	- 3	20	100	10	+		-	588	21	11	mir.	+	:	:	:	100
Biological Survey	: ;	, E	, ;	c co	3 .	. 82	-	_	9	13	7-	6	바		:		203
Chemistry and Souls	7	2 2	100	G	12	က		_	31	10	TÎ.	31	ಜ	:			97
Darry Industry	e e) T	2	=	2	ဗ	-	_	26	103	89	35	22	31	:		863
Entomology	- 3	٤3	. s	• 01		01			35	83	0	10	+	2		:	<u>8</u> 5
Experiment Stations	ų.	· -	> cr	- 0	55	· ©			:		65		83		:		ŝ
Extension Service	: 2	· -	2 10	11	: 9) ox			<u>x</u>	7.3	33	16	20	જ	:		303
Food and Drug Administration	<u>;</u> ;	- °	: ·	+ 01 +	9	7	-	-	159	33	59	31	32	S 55	õ	ಐ	41.9
Forest Service	:	3	•	:		-	-				1	_	ಯ	_			∞
Grain Futures Administration	: %	: =	. o	: 3	. =	-					•		:	:		:	33
Home Economics	0	-	0	, ,	-	-		•									જ
Information	: 0	. ~	. ~	-						• •							16
Library	. ee		. 02	00	, <u>, , , , , , , , , , , , , , , , , , </u>	. 8	. –	_	G#	13	=	89	30	10			554
Plant Industry	5	Ş		,													
Plant Quarantine and Control	-	1	-	-	÷	83	_		150	10	2.58	6	22	_	:	:	311
Administration	. 10		00	S	00	(-		_	101	8	11.3	÷30	7.8	18			503
Public Roads			; <u>-</u>		=======================================	=	-		-		9	31	9	:			500
Secretary's Office	: 31	. 20	9	. –	10	-1-	:	_	91	133	09	7	633	2	:	:	398
Tokal	191	555	580	153	291	128	13	=	1099	1612	693	217	365	13	31	8	5346
Total Control of the																	





TABLE 3

Number of Professional Positions by Bureaus and Occupational Groups

BUREAU	ECONOMICS	AGR., BIOL. & PHYSICAL SCIENCE	VIEDICAL SCIENCE	VETERINARY	1.F.GAL	LIBRARY	ENGINIERING	TOTAL
Agricultural Economics	144	151				111		376
Agricultural Engineering	1					1	79	81
Animal Industry		117		1343		1	1	1112
Biological Survey		90		1			9	100
Chemistrycand Soils		285	- 1			1	16	303
Dairy Industry		71		1		1	4	76
Entomology		362				1		363
Experiment Stations	1	38				3	1	43
Extension Service	7	3.5			٠.	1		43
Food and Drug Administration		500	6	ő		1		305
Forest Service	21	395					50	469
Grain Futures Administration	5	6						8
Home Economies	51	11				1		33
Information		4						4
Library						16		16
Plant Industry	3	514				7		524
		309					5	311
Public Roads	9	15				1	177	502
Secretary's Office		1			\$2			52
Weather Bureau		397				1		398
Total	213	3054	7	1330	48	47	637	5316

 ${\bf TABLE~4} \\ {\bf \times_{t,viber, of, Professional, Positions by Classes, and Grade or Salary Group}$

			4	AL ARY	GROU	Р			AL
CLASS	P-1	D-5	P-3	P-1	P-5	P-6	P-7	P-S	TOT
Agricultural Attache						3			3
Agricultural Chemist			1						1
Agricultural Commissioner			1	9	-5	1			9
Agricultural Economist	19	36	33	16	58	8	5	1	143
Agricultural Editor					1				1
Agricultural Engineer	S	6	9	10	1		1.		38
Agricultural Extension Economist					1				1
Agricultural Statistician		1	- 6	7	14	-5			32
Agricultural Technologist				1					1
Agricultural Transportation									
Economist					1				1
Agricultural Writer				1	2	1	1		5
Agriculturist			- 5		15	8			25
Agronomist		- 59	60	10	18	12			145
Animal Fiber Technologist									1
Animal Husbandman		7	14	1	9	1			38





TABLE 4 (Continued)

Number of Professional Positions by Classes and Grade or Salary Group

	P-1	P-9							
estandenniae		1 -2	P-3	P-4	P-5	P-6	P-7	P-8	
piculturist		4	5	1	1				1
rchitect		1			1				
rchitectural Engineer		1	٠.		1				
ttorney		4	14	2	11	4			Ç
utomotive Engineer		1							
acteriologist	. 7	6	10	2	8	1			6
ibliographical Assistant	. 1								
ibliographical Entomologist		1							
iochemist		6	9	3	13	2			4
iological Chemist				1					
iological Editor				1					
iologist		20	13	6	12	4			5
iophysicist		2	1						
otanical Artist			1						
otanist	10	11	7	3	4	8			4
adastral Engineer		1	1	1					
artographer			4						
hemical Engineer	3	ű	3	2	1				1
hemist	91	114	85	42	52	19	1	1	40
ivil Engineer	- 8	Q	1		1				1
lub Organization Specialist					1				
olor Technologist		1	1						
onstruction Engineer		1	1						
ousulting Architect								1	
onsulting Highway Engineer					1				
onsulting Mathematician								1	
otton Technologist	2	3		2	3				1
otton Grade & Staple Estimator	4								
rop and Livestock Estimator		7	16	8	7				
ytologist		1	2						
airy Husbandman		4	2	2	9			1	1
airy Manufacturing Specialist	1	5	6		2	1]
evelopment Engineer			ĺ		~	-			
irector of Extension Work								1	
irector of Personnel & Business		• •							
Administration							1		
irector of Regulatory Work								1	
irector of Scientific Work								1	
istrict Forest Inspector					4				
istrict Law Officer					6				
rainage Engincer		2	2		7				1
rug Control Inspector						1			
ust Explosion Engineer		1							
cologist			1						
conomia Geologist			- 1						
conomic Geologist			- 1		1			• •	
conomic Zoologist		1		* *	2	1			
conomist					1				
lectrical Engineer		• •			1			• •	
ngineer		11	10	7	11	7			

77.

TABLE 4 (Continued)

Number of Professional Positions by Classes and Grade or Salary Group

			S	ALARY	GROU	P			
CLASS	·-1	P-5	P-3	P-4	P-5	P-6	P-7	P-8	
Engineer of Tests			4	1	. 3				
Entomologist	84	104	78	47	39	11	1	1	3
Prosion Scientist			2	6					
Exhibits Specialist			1		1				
Extension Forester				1	1				
					2				
Extension Specialist in Home									
Management	٠.				1				
Sarm Economist					1				
eed Technologist	• •		1						
field Agent—Negro Work			į.						
Food and Drug Inspector	37 -		s s	4	15	2			
Food Control Inspector	J.					1			
Poor Control Anspector	133	27	11	3	12	5	1	5	1
Forester	100	÷ /	3	í					
		5	1	2	. 9	3	1		
Forest Economist		0			9				
Forest Inspector			- •		~	1			
Forest Products Engineer			1						
Forest Products Statistician	υ.				1				
Forest Ranger	-2	1	1						
Forest Supervisor								1	
rorest raxation Economise									
Geneticist			5	ń	1			• •	
Grain Exchange Supervisor					5	2	1		
Grain Inspector	1							• •	
Grain Technologist		5	1					• •	
II' 1. Cassialist		1	1						
Hide Specialist		6	18	6	14	5			
Highway Economist		3	I	1	ű				
Righway Engineer	99	69	97	4.5	69	55		1	1
Highway Engineer					4				
Highway Research Specialist	, ,	1							
Highway Transportation Engineer		1							
Home Demonstration Agent	6	5	6	1	2		F		
Home Economics Specialist			- '		.5				
Home Economist	3	7.	19	10	15	5			
Hortienlturist	1	1.	1						
Hydraulic Engineer	A		1						
Hydro-Electrical Engineer									
Industrial Engineer			1						
Insect Pathologist					1				
Justicetor of Grazing					1				
Irrigation Economist				1					
Irrigation Engineer		6	4	2	1	1			
			ű.						
Laboratory Inspector			1						
Land Classification Specialist	1	1			1				
Landscape Architect	. 1	1	1	1	1				
Land Valuation Engineer					1				
Librarian	. ''•)	11							
Livestock & Meat Technologist .			1						





TABLE 4 (Continued)

Number of Professional Positions by Classes and Grade or Salary Group

cLAS9	P-1	77. 0							
ivestock Statistician		P-2	P-3	P-4	P-5	P-6	P-7	P- 8	E VE
						1			
ogging Engineer			4		5				
Isolating Foonamist	. 1	2							
Larketing Economist Larketing Specialist		1	1	• •	• •	• •	• •	• •	
larket Milk Specialist		1	3	1	1				
laterials Engineer		وَ	3						
Iechanical Engineer		3	4	1]
Iedical Officer		1	1	3	1				
Ieteorologist	.142	141	65	8	28	12		1	39
licroanalyst		1		1					
licroscopist		1	1		1	1			
Iycologist	2	1			1	1			
laval Stores Classifier		4		1					
aval Stores Classifier		*2	• •	1	• •	• •	• •	• •	
fier		1							
ematologist		i		• •	1	1		• •	
lut Chemist			ì		î				
			-	• •	_	• •	• •	• •	
Plericulturist				1					
arasitologist			1	2					
athologist		36	53	19	39	16			1
etrographer			1						
harmacologist					1				
hysicist		4	5	1	ī	1			
hysiological Plant Anatomist		1							
laysiologist		3	13	7	7	5	1		
lant Breeder		2							
lant Ecologist				1					
Plant Historian		1							
Plant Physiologist			1	1					
lant Quarantine Administrator	·					1	1		
Plant Quarantine Inspector	146	96	56	9	5				ń
'omologist		7	5	4	5	1		1	
Oultry Husbandman			3		1				
Poultry Technologist	• • • •			1	• •			• •	
Radio Engineer	1								
Range Examiner		6	5		2				
Refrigeration Engineer			ŀ						
Regional Engineer			1		6				
Regional Forester					50	7	1		
Regional Forest Inspector			1	3	.5				
Research Assistant		1							
cientific Assistant		• •	1		• •				
cientific Illustrator			1	• •	1				
Scientist			1.5	10		1		• •	
Silviculturist			15	10		_			
Soil Petrographer			3	-	6				
Soil Scientist					0				



89

NUMBER OF PROFESSIONAL POSITIONS BY CLASSES AND GRADE OR SALARY GROUP

CLASS				SALAR	Y GROT	UP			
	P-1	P-2	P-3			P-6	P-7	P-8	
Soil Technologist		5	8					A -0	
Solicitor				• •	• •				
opecialist		* *	• •		• •			1	
specialist in Cattle Breeding		• •		1					
PUBLISHCAL Analyst		• •	٠.	• •		1			
reaction can rangineer	• •	• •	٠.		1				
Statistician	٠.	• •	1						
Stockyard Appraiser		٠.	1	٠.					
Structural Engineer		٠.	2					• •	
Sugar Technologia	-5		1		1	1		• •	
ugar Technologist	3	1					• •	• •	
burveyor			1			• •	* *	• •	
Caxation Economist					• •	• •			
es Evanium				2					
Cea Examiner		3	1					• •	
Cechnical Reviewer				1	Q		• •	• •	
Sechnical Writer		l				• .			
cchnologist	3		3	1	3	• •		• •	
extile Technologist	1				J	• •			1
imber Expert			2			• •			
the Attorney			6			• •	٠.		
Oxicologist		• •			٠.				
ransportation Economist					1				
ruck & Fruit Crop Estimator.					1				
	• •		i)						
cterinarian	10	890	121	17	4.1	_			
etermary Sanitarian	વ		131	1.4	41	7	1	1	132
ISHAL Instruction Co. J. P. a		٠.							;
	٠.	* *		1					
ood Technologist		1	3	2	1				
ool Technologist	•		• • •	-	1				,
	•			1					1
ylotomist	1					1			
				* '		1			2
pologist	6	5	3	1	2	1			18
Total classes 188									
# No.	9 1	000	202						
	0 1	837	983 3	370 - 6	359 - 9	203	15	17	5346

VALUE OF HIGHER ACADEMIC DEGREES

The question is often raised as to the value of a higher academic degree as a factor in the advancement of employees to positions of greater responsibility and emolument. So many factors condition such advancement that conclusions as to the influence of a degree in the attainment of a position of higher rank may be of very doubtful value. However, the study of the professional employees of the department set forth in Table 6 will afford material for some speculation on this problem. Considering the 203 employees in



	Positions
	PROFESSIONAL
	OF
ध्य	CLASSES
TABLE	PRINCIPAL (
	O.F.
	BUREAUS OF]
	BY B
	LOCATION

1	VETERINARIAN			32				:			:	•						:				33(
ı	SURVEYOR	•	• •	_		٠		٠	۰	٠	٠		٠	٠	•	•	٠	•		•	• [
	SOIL	:	:	:		4	:	•			•	:	:		•		:	•			:[47	
	POMOLOGIST		:	:	:	:	:	:	:	:	:	:	•	:			3,			:	1	35	
	INSPECTOR																	C)		-1	6	
	TVA.1q	:	:	:	:	:	:		•	:			:		:		:	628		:	:	979	
	PHYSIOLOGIST	:	:	:	: 0	24	:	:	:	:	:	:	:	:	:	- (36	_	•	:	:	39	
	TSIBOLOHTAT	:		:		:			: '	_	:						633	**			:1	89	
	TVAIT		٠	٠	٠	٠	٠	٠	٠		٠	٠	٠	•	•	•	=			•	•	-	
	METEOROLOGIST	:	:	:	:	:	:	:	:	:	:	:	•	:		:	:		•		33	397	
	TSIMULTURIEL	:	:	:	:	:	:		-	_		:	:	:	:	:	44.	~		:	:	99	
	BRIDGE EZGLZEER					:	:				:	•					:		٠ ,	2	:1	94	
7. 17.	піснилук						٠													7	• [١
2016	AVMH9III					:		•		:		:		:			:		. 4	34		207	
WI ICM	FORESTER	:	:		15	:	•		:	:	:	179	:	:	:	:	œ		:	:	:	199	
-	LOOD & DRUG	:	:	:	:	:	:	:	:	:	06	:	:		:	:				:	:	06	
5	EXTOXIOLOGIST			:	••			3 13	31		55		•				:	85	CT			865	
CVT	CHEZHST	-	:	22		70	50	33	120		(59	2.1	•	10	:	:	ಛ	-	→ ‹	ಐ	:	405	
110	TSINATOR					<u> </u>			31								_				. 1	\$5 20	
			٠			٠	٠	٠		•	•	٠	•	٠	٠	٠	erte.		•	٠	- 1	_	
131 4	BIOLOGIST		•	4	76	:	•		•	•			:	:			:			:	-	$^{\circ}$	Ì
20	HUSBANDMAN	;	•	31	:	:	•	•	5-		•									:		38	
r. 7 -:	TSHZONORDA	:	:	:		-			(~	31	•		:	•	:		134	-	_		:	155	1
131 141	EZGIZEEB VCBICCLICBYL	:	36			:			~			-										1 %	١
=	ECONOMIST	. xx	:				:		31			:	31				_		:	_		44	
	AGRICULTURAL	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \														•		· ·	•	:		-	
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											HOI		110	•	•			70.					
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	BUREAU	7	1	dus	Sur	/ an	net	TOTAL CALL) 2 =	3	Dr	V.	ME	0110	110			เลรา	tration	Spen	Bur		Torse
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		Aericultural Economies	rrice	Animal Industry	Biological Survey	Chemistry and Soils	Doing Tochacter	Futomology	Experiment Stations	Extension Service	Food and Drug Administration	J. P. C. S.	Grain Futures Administration .	Home Economics	Information	l'ira	Plant Industry	Plant Quarantine & Control A	-	Public Roads	Weather Bureau	t	
	l.	1 -	7	-	· ~	Ū	2	i i	i i	1	i pi	, E	ۍ .	H	H	_	: =			4	-		



TABLE 6

DISTRIBUTION OF EMPLOYEES IN THE PROFESSIONAL SERVICE BY GRADE OR SALARY GROUPS AND HIGHEST ACADEMIC DEGREE

			5	SALAR	Y GROU	P				CENT
DEGREE	P-1	P-9	P-3	P-4	P-5	P-6	P-7	P-	S TOTAL	PER CE
None	164	231	153	45	81	13	2		689	12.8
Bachelor	702	439	384	141	241	61	3	3	1974	36.9
Master	143	535	210	93	163	43	<u>ي</u>	4	890	16.6
Ph.D	1	43	110	65	114	53	4	3	393	7.3
M.D	1	ű	3	3	8	2			19	0.3
LL D., Litt.D., D.C.L.		ž.,		3	9	23	3	6	44	0.8
D.V.M., V.S.,D.V.S., etc		890	155	50	43	8	1	-	1337	25.0
Total	263	1837	982	370	659	203	15	17	5346	99.7

grade P-6, it will be observed that 23 or 11.3 per cent have the degree D.Sc., D.Agr., etc.; 53 or 26.1 per cent have the degree Ph.D.; 43 or 21.1 per cent have a master's degree; 61 or 30 per cent have a bachelor's degree, and 13 or 6.4 per cent have no academic degree. It should be stated that in case an employee has both the degree Ph. D. and the D.Sc. or D.Agr., the latter two were disregarded in this tabulation. On the whole the evidence from the table is favorable to the view that a higher degree is a distinct factor in advancement.

Among the several bureaus of the department there is a wide variation in the degree status of the employees in those units. For example, in one bureau the number of employees with no academic degree is 0.3 per cent of the total and in another bureau 77.8 per cent. The complete data for all bureaus is given in Table 7. There is a threefold reason for the occurrence in the Professional Service of the relatively large number of employees with no academic degree. (1) When the Classification Act of 1923 became effective the Personnel Classification Board arbitrarily placed in the Professional Service certain existing classes of positions for which an academic degree had not been previously considered as a prerequisite. This in effect blanketed into the Professional Service a substantial number of employees who had no academic degree. (2) Certain positions that have been placed in the Professional Service sometimes are filled without requiring college graduation as a qualification. (3) In the case of the Weather Bureau no college at present affords



TABLE 7
Percentage by Bureaus of Professional Employees Holding the Academic Degrees Indicated

				PERCEN	TAGE	WITH		
BUREAU	NO. OF EMPLOYEES	No Degree	Bachelor	Master	Ph. D	M. D.	D.Sc., D.Agr., D.C.L. I.L.D., Litt. D.	D V.S., D.V.M., V.S., etc.
Agricultural Economics	276	13.4	43.1	31.1	11.2	0.8	0.7	
Agricultural Engineering	81	6.1	77.7	16.0				
Animal Industry	1442	0.3	4.0	2.3	0.9	().2		919
Biological Survey		23.0	49.0	19.0	5.0	2.0		2.0
Chemistry and Soils	303	3.9	45.5	25.1	23.4	0.6	1.3	
Dairy Industry	76	13.1	44.7	22.3	17.1		1.3	1.3
Entomology	363	6.3	49.0	26.1	17.0		1.3	
Experiment Stations	43	6.9	44.1	27.8	11.6		2.3	6.9
Extension Service	43	18.6	44.1	23.2	6.9		6.9	
Food and Drug Administration	305	13.8	56.3	19.8	4.9	2.6	0.3	1.6
Forest Service	469	5.7	47.7	40.0	5.1		12	
Grain Futures Administration	- 8		50.0	37.5			12.5	
Home Economics	33	0.3	21.2	95.4	30.3			
Information	4	25.0	75.0					
Library	16	25.0	75.0					
Plant Industry	521	4.1	36.2	32.6	24.0		2.8	
Plant Quarantine and Control Ad-								
ministration	311	12.2	78.7	8.3	0.6			
Public Roads	502	20.5	69.1	9.5	0.6		0.2	
Secretary's Office	52	28.8	53.8	11.5	1.9		3 8	
Weather Bureau	398	77.8	16.5	2.5	5 ()	0.5	0.5	

the special training in meteorology necessary to the work of this bureau. Young employees, without college training, who have entered the service in minor positions, are advanced to positions in the professional service as soon as they have acquired by actual experience the knowledge necessary to perform the duties required.

AGE FACTOR

The ages of the professional employees in the department range from 21 to 75 years. In Table 8 it is seen that beyond 30 years, age appears to be a factor of little importance in an employee's advancement to successively higher salary groups. Of the total number of employees, 4049 or 75.5 per cent are found between the ages 25 and 50 years inclusive, and 1161 or 21.2 per cent are

TABLE 8

Distribution of Employees in the Professional Service by Age and Salary Group Attained

AG					SALARY	GROUP				TOTAL
(A	pril, 1931)	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	10
21										4
2.2		18								18
2:3		51	• •							5]
24			4							- 88
2.5		99	17	1						11'
26		89	24	1	• •]].
27			31	9						$\frac{13}{15}$
2 %		105	41	11	I -					15
29			50 40	14 16	5 e	3				113
\${} > 1		53		27	$\frac{6}{6}$	4				15
31		42	64 75	55	10	6	1	1		15
\$12 \$13			49	35	9	6	4			14
3 1		40 32	61	31	11	6	**			14
3.5		46	59	37	15	8				16
36i		47	72	46	16	15	1			19
37		37	76	42	14	10	i			18
34		65	79	50	55	18	3	1		19
351		. 33	56	35	23	51	5			17
11)		98	68	31	23	23	5			17
11			69	49	23	31	8			21
1 ?		20	63	46	26	39	7]		50
13		. 21	65	43	17	31	7	1		18
1.1		. 15	61	27	1.5	2.5	6		1	1.5
1		13	56	36	1.5	28	7	1]	1.5
11,		. 9	54	30	11	35	6]	1	14
17		. 18	45	55	15	42	- 8			15
15		4	52	28	8	23	6	1]	15
11)		15	43	25	4	31	8			15
5/1		. 8	50	24	6	25	15]	13
51		. 5	46	18	1.5	35	11]		15
5)		1	43	19	5	23	6	2]	10
5.1		. 6	- 26	19	5	51	6		3	8
1 4		3	4.4	55	7	17	7		5	10
3.3		7	28	18	5	10	6			7
5ti		5	31	14	7	50	10		1	8
,,-		1	26	11	7	6	10			6
55		2	58	50	1	19	4	1		7
59		3	39	11	6	8	8	1	• •	7
60		. 2	15	14		9 ~	4]		4
61		1	16	15	2	7	4	1	• •	4
(iV		. 1	16	13	ő	11	6			4
13		1	6	17	9	7	6			3
£. \$			15	6	1	9	8		1	1
(.5			6	3	1	4	5	1	1	
66			6	3		4	3			1
67		2	6	3		1	3 =====================================		٠.	1
65		3	9	8	1	4	5		5	3 1
60	• •	. 1	3	5		6	1			1



TABLE 8 (Continued)
DISTRIBUTION OF EMPLOYEES IN THE PROFESSIONAL SERVICE BY AGE AND
SALARY GROUP ATTAINED

AGE		SALARY GROUP									
(April, 1931)	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	TOT		
70	2		2	1	3	2			10		
Л	1	2			3				6		
iz	2	2	1	1	1	1			8		
′3	1		1			1		2			
4			1			2			5		
'ā					1]		
Total	.1263	1837	982	370	659	203	15	17	5346		

above the age of 50 years. The distribution by age groups is as follows:

Age in Years	Number
21 to 30	957
31 to 40	
41 to 50	1574
51 to 60	
61 to 70	
71 to 75	

As may be expected the distribution by years of service, as seen in Table 9, does not follow closely the distribution by age. This table also shows that after the twenty-fifth year of service there begins a sharp reduction in the total number of employees. Now, by far the largest number of appointments are made in the junior and assistant grades, P-1 and P-2 respectively, and the approximate age of appointees is about twenty-five years. At the end of twenty-five years of service these employees would have attained the age of approximately fifty years. The suggestion has been made that the decline in the number of employees at about their fiftieth year is directly related to the decline in number after twenty-five years of service, but such a conclusion could be accepted only after verification based upon a study of the appointees in each of the preceding twenty-four years.



TABLE 9

DISTRIBUTION OF EMPLOYEES IN THE PROFESSIONAL SERVICE BY YEARS OF SERVICE AND SALARY GROUP ATTAINED

YEARS OF			SALAR	Y GROU	r			
SERVICE P-1	P-5	P-3	P-4	P-5	P-6	P-7	P-8	TOTAL
ppointed in 1931 68	56	30	10	4	3			14
1305	69	51	55	26	3		1	477
2232	83	53	19	17	4		1	409
3172	84	50	13	19	8		1	31
4110	60	26	8	8	õ		3	21
5	59	50	11	13	4	1	1	18
6	52	30	6	10	3		1	14
7 40	85	34	13	17	3			19
8	48	38	13	20	2	2		14
9	67	27	14	20	4	1		15
10	64	43	6	14	2			14
11	66	43	20	30	4			17
12 14	105	66	36	33	8	1	2	26
13	108	49	24	34	5			24
14	112	50	30	41	6			25
15	. 45	14	9	18	4			10
16 7	63	21	11	13	10			12
17 9	96	30	25	17	8	1		18
18 7	51	25	12	29	10		1	13
19	25	16	6	17	5			7
20 5	74	31	11	27	6			1.5
21 3	30	27	5	31	7			10
ફુરૂ 5	11	22	5	23	9	1		7
23 7	72	24	3	19	6			13
21 7	50	25	11	38	11	2	1	14
25 4	67	29	7	23	5	2		18
26 2	10	6	2	10	6			5
27 2	30	18	7	12	9			7
28 1	24	9	2	10	3	2	1	É
29 4	21	11	1	8	7			ŧ
30 3	14	11	4	14	7	1		5
31 2	16	10	1	6	2			5
32	11	4		3	2			2
335	11	6	2	8	6			6
34	3	4		1	1		1	1
35	2	6		3	1	1]
36	3	3	1	4	1]
37	1	2			2			
38	3	2		1	1			
39		1		2	1		1	
40	2			3	4		1]
41	. 2	3		1				
.49	4	1		1	1			
43	1	2			2			
44	2 2	1		2	1			
45				1				
46		3		1	1			
47				2			1	



TABLE 9 (Continued)

DISTRIBUTION OF EMPLOYEES IN THE PROFESSIONAL SERVICE BY YEARS OF SERVICE AND SALARY GROUP ATTAINED

YEARS OF				SALARY	GROUP	,			
SERVICE	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	
48	1	1	4		2				
49					2	1			
50		1							
51			1						
52									
53					1	2			
Total	1963	1837	982	370	659	203	15	17	5

DISTRIBUTION OF PROFESSIONAL AND SCIENTIFIC EMPLOYEES BY INSTITUTION GRANTING DEGREES

The positions in the salary group \$5600 to \$6400 are for the most part occupied by the heads of important bureau subdivisions. They represent posts of large responsibility and are filled by promotion from the next lower salary group, if individuals of suitable fitness are available. Otherwise selection is made through civil service examination. It has been of interest to determine the institutions from which this group received their most advanced degrees, as a possible indication of the source from which the most desirable applicants have been secured in the past. It appears that 139 agricultural economists represent 59 different colleges and universities, 138 agronomists represent 42 institutions, 400 chemists represent 159 institutions, 166 plant pathologists represent 63 institutions and 341 entomologists represent 80 institutions. The largest number from any one institution is as follows: agricultural economists, 21 from the A. & M. College of Texas; agronomists, 28 from Kansas State Agricultural College; chemists, 26 from George Washington University; plant pathologists, 11 from the University of Minnesota and the University of Nebraska, respectively; and entomologists, 48 from Massachusetts Agricultural College.

CAREER ASPECTS

The limitations of this paper do not permit an extended discussion of the advantages and disadvantages of a career in the public service. Moreover this is a topic concerning which opinion is far from unanimous. The most authoritative statements on this



subject with especial reference to government employment conditions as compared with those of outside industry appear in a series of remarkable reports issued by the United States Personnel Classification Board from which the following "findings" are quoted from the second report:3

The government pay scale for positions in the professional and scientific service compares favorably with the average pay for similar non-government positions below the \$3800 level, but above the \$3800 level the government pay scale is lower and the discrepancy becomes greater as the importance of the work increases. (p. 119)

For professional and scientific positions the government salary scale is generally more liberal than the average salaries for similar positions in the larger colleges and universities (not including extra-curricular income), although these same positions command a considerably higher rate in some of the institutions in question. (p. 120)

The salaries paid by private concerns to their major executives exceed those paid by the federal government anywhere from 100 to 500 per cent (p. 122).

The leave privileges in the federal service are generally more liberal than

those in private employment. (p. 127)

Non-government employers do not generally provide retirement systems, but in some cases systems even more liberal than the federal retirement plan are provided, such as group insurance and cooperative stock purchasing plans. (p. 127)

The civil service requirements for employment in the federal service are more exacting and thorough than entrance requirements generally for non-government employment. (p. 128)

PROBLEMS IN PREPARING PERSONNEL SPECIFICATIONS

Of all the published specifications for different classes of positions, those of positions in the federal field service issued by the Personnel Classification Board in 1930 are beyond doubt the most complete and definite.4 But this completeness in itself may prove to be a serious disadvantage in the work of allocating field positions to the appropriate grade. Aside from personnel officers, probably few employees have either the time or the inclination to master the fundamental principles of classification and the voluminous detail of these class specifications. Far too many employees, including some administrative officers, have the impression that the class specifications afford a convenient mechanism for securing increases in compensation and apparently entirely disregard the fact that

³ Personnel Classification Board, Report of Wage and Personnel Survey, 70th Cong., 2d sess., H. Doc. No. 602 (Washington, Government Printing Office, 1929), 511 pp. Personnel Classification Board, Closing Report of Wage and Personnel Survey (Washington, Government Printing Office, 1931), 404 pp. Feldman, H., A Personnel Program for the Federal Civil Service, A Report Transmitted by the Director of the Personnel Classification Board (71st Cong., 3d sess., H. Doc. No. 773, Washington, Government Printing Office, 1931), 289 pp. Personnel Classification Board, Preliminary Class Specifications of Positions in the Field Service (Washington, Government Printing Office, 1930) 1327 pp.



the purpose of classification is not to increase salaries but to establish a reliable and systematic grouping of comparable positions and to equalize rates of pay.

Although the writers of these specifications made commendable efforts to establish an unmistakable line of demarcation between successive grades in each series, they were not wholly successful, since the distinction between grades is based upon differences in importance, difficulty, responsibility, and value of the work performed. Unfortunately these characteristics do not obligingly become discontinuous at the points arbitrarily fixed in the compensation schedule as the dividing line between grades, with the result that honest and sometimes disingenuous differences of opinion arise between employee and supervisor or between supervisor and personnel officer as to the proper allocation of a given position. The foregoing statements are not to be construed as a criticism of the specifications in question, but as an illustration of a difficulty that is certain to arise in their application unless there can be developed in each administrative unit a group of employees trained in the technique of personnel management to insure uniformity of appraisal of the duties and responsibilities involved in each position.

Although the specifications promulgated by the Personnel Classification Board provide an indispensable working tool in personnel administration, they are not the most satisfactory guide to university training for the federal service, a purpose for which they were not intended. The work that the American Council on Education has undertaken in this field promises to yield results of primary importance to those concerned with the training of university students. As a part of their general program, representatives of the council enlisted the aid of officials of the Department of Agriculture in securing definite information regarding the requirements of various pursuits in the professional service. This information has been resolved into a series of "Criteria of Successful Achievement" for various pursuits, such as chemist or botanist, in which is presented for the whole body of workers in a given pursuit a composite of their activities and the manner of their performance of them. Aside from their prospective usefulness as a guide in the training of students, these criteria serve to give employees a better understanding of the objectives for which they



should strive in their work. Commenting thereon one chief of burean said, "These criteria have given the men in my burean a better idea of the training and experience necessary to fill a given job and have impressed upon them the fact that they had never before fully appreciated the scope and importance of their positions"; and another, "We have found these criteria helpful in securing a desirable kind of examination, and as an aid in visualizing the kind of men needed to fill our positions." It is sincerely to be hoped that these important studies of the council may be earried forward to early completion.

CIVIL SERVICE EXAMINATIONS FOR SCIENTIFIC PERSONNEL

The scientific personnel of the Department of Agriculture is recruited through open competitive civil service examinations, which may be either assembled or unassembled. In the assembled examination applicants are rated according to the correctness of their response to a set list of questions relative to the subject of the examination and on a thesis submitted on the day of examination. Sometimes the applicant is rated on education, training, and experience also. In the unassembled type of examination applicants are usually rated (1) on education, training, and experience, and (2) on publications or a thesis.

For admission to an examination of the junior grade there is a general preliminary requirement of applicants to show that they have been graduated with a degree from a college or university of recognized standing with the completion of at least 118 semester credit hours. Applicants for admission to examinations above the junior grade must show that they have the requirements of that grade and in addition:

1. In the assistant grade, two years' successful experience or two years' postgraduate study in the general subject of the examination.

2. In the associate grade, three years successful experience or three years' postgraduate study in the general topic of the examination.

3 In the full professional grade, experience and postgraduate study totaling at least five years

4 In the senior grade, experience and postgraduate study totaling at least

5 In the principal grade, experience and postgraduate study totaling eight to

These are typical requirements and are frequently modified to meet special conditions or needs.

When a position of unusual importance is to be filled the usual



form of civil service examination may not be used but instead the qualifications of candidates are passed upon by a special board of examiners composed of representatives of the United States Civil Service Commission and of representatives from other organizations who are eminently qualified in the general subject of the examination. The kind of qualifications required for an examination of this type are shown by the following excerpt from an examination for senior toxicologist held November 30, 1930.

Qualifications.—The examination will consist solely of the consideration of qualifications by this special board. The minimum qualifications for consideration are education equivalent to that represented by an M.D. degree from a college or university of recognized standing with major work in toxicology, pharmacology, zoology, physiological chemistry, or a closely related branch of science, and experience in important research or experimental work in pharmacology or toxicology, or both, of sufficient length and character to demonstrate keen judgment and perception of the scientific problems fundamental to the duties of the position. The appointee must possess executive ability and be free from personal traits and interests that might interfere with the smooth operation of the division. This position is of a highly specialized character and of great importance, and it is desired to secure the services of a person who has had broad training and wide experience in toxicology or pharmacology, or both, and in the supporting branches of science, and who is well qualified to initiate research and handle work of cooperative and supervisory character. With these ends in view considerable weight will be given to the applicant's general reputation and attainments.

The number and title of the examinations held in 1930 from which appointments were made by the United States Department of Agriculture are shown in Table 10. The number of appointees, by salary groups, from these examinations is likewise shown. Of the 129 examinations held, 44 were assembled and 85 unassembled. In two of the latter cases the qualifications of candidates were passed upon by a special board of examiners.

We believe that courses pursued by students in preparation for appointment in the federal service could be advantageously modified in certain respects. A frequent and often well-merited criticism of many college graduates who enter the service is that they are poor in English composition and are therefore unable to present the results of their work in a form either suitable for publication or creditable to themselves and the organization they serve. If a fair proportion of the time now devoted to the training of students to undertake research work were devoted to training them in the art of presenting in suitable form the results of investigations, a marked improvement in the clearness and intelligibility of the writings of students so trained would certainly become evident.



TABLE 10

Enaminations Held in 1930, and Number of Appointees therefrom by Grades, From January 1, 1930, to May 31, 1931.

		SALARY GROUP P-2 P-3 P-4 P-5 P-						
TITLE OF ENAMINATION	P-1	P-2	P-3	P-4	P-5	P-6	5	
unior Paper Technologist	1							
aper Technologist				1				
unior Animal Fiber Technologist (Wool & Mohair)								
ssistant Soil Technologist (Soil Fertility)		5						
unior Plant Quarantine Inspector	51							
unior Agronomist	7							
unior Agronomist (Western Irrigation Agriculture)								
ssistant Forage Crop Agronomist		7						
ssistant Sugar Beet Agronomist		3						
ssociate Agronomist (Dry Land Agriculture)			1					
unior Animal Husbandman (Horse Investigations)	1							
enior Dairy Husbandman (Extension)					1			
unior Biochemist (Horticulture)	1							
ssociate Biochemist (Animal Body Fluids)			1					
unior Biologist (General)								
unior Biologist (Poultry)	3							
unior Biologist (Food Habits Research)	9							
ssistant Biologist (Food Habits Research)		2						
unior Nematologist								
unior Pathologist	2							
unior Pathologist (Plant Quarantine Inspection)	.10							
ssistant Plant Pathologist (Vegetable Diseases)		1						
ssistant Plant Pathologist (Vegetable Diseases)		٠.	4					
Associate Pathologist (Sugar Cane)			2					
Associate Pathologist (Forage Crops)			1					
Plant Pathologist (Tobacco Investigations)				2				
Plant Pathologist (Vegetable Crops)				1				
Pathologist (Sugar Cane)				2				
Senior Pathologist (Cereal Smuts)					1			
Senior Pathologist (Barberry Eradication)					1			
unior Physiologist	1							
Associate Physiologist (Fruit & Nut Investigations)			1					
Physiologist (Fruit & Nut Investigations)				4				
unior Pomologist	2							
Senior Pomologist					2			
Innior Seed Botanist	4							
unior Soil Surveyor	3							
unior Chemist	96			• •				
Assistant Chemist (Advanced Inorganic)	* ()	1		• •	• •			
Assistant Physical Chemist	• •	2	• •			• •		
Assistant Physical Chemist				1		• •		
Chemist (Vegetable Biochemistry)				ı	1			
Senior Physical Chemist				• •	1			
Senior Food Chemist					1			
Junior Librarian								
Junior Home Economics Specialist (Clothing Design) Junior Home Economics Specialist (Foods and Nu-	1	• •						
trition	1							



TABLE 10. (Continued)

Examinations Held in 1980, and Number of Appointees therefrom by Grades, Enom January 1, 1980, to May 31, 1981.

	SALARY GROUP								
TITLE OF EXAMINATION	P-1	P-2	P-3	P-4	P-5	I'-6			
Home Economics Specialist				1					
unior Civil Engineer	37								
Junior Mechanical Engineer	-1								
Iunior Agricultural Engineer									
Junior Chemical Engineer									
Assistant Chemical Engineer		1							
Assistant Civil Engineer		3							
Assistant Highway Engineer		14							
Assistant Structural Steel & Concrete Bridge Engineer .		2							
Assistant Material Engineer		1							
Assistant Hydraulic Engineer		1							
Associate Agricultural Engineer			3						
Associate Chemical Engineer			1						
Associate Civil Engineer			1						
Associate Highway Engineer			17						
Associate Structural Steel & Concrete Bridge Engineer			3						
Civil Engineer				1					
Senior Civil Engineer				•	0				
					1				
Senior Architectural Engineer					1				
Senior Agricultural Engineer (Extension Specialist)			• •						
Junior Forester			• •						
Junior Range Examiner									
Fimber Expert			3						
Junior Food and Drug Inspector		11.							
Junior Veterinarian									
Junior Cotton Grade and Staple Estimator									
Junior Bacteriologist (Food Products)									
Assistant Bacteriologist (General)		1							
Assistant Bacteriologist (Food Products)		1							
Associate Bacteriologist (Food Products)			5						
Junior Entomologist (Insect Habits & Development) .									
Junior Entomologist (Insecticide & Physiology)									
Junior Entomologist (Cultural Control)	9								
Junior Entomologist (Taxonomy)	5								
Assistant Entomologist (Apiculture)		- 1							
Assistant Entomologist (Biological Control of Insects)		ú							
Assistant Entomologist (Cereal & Forage Insects)		1							
Assistant Entomologist (Cotton Insects)		2							
Assistant Entomologist (Forest Insects		1							
Assistant Entomologist (Truck Crop Insects)		2)							
Associate Entomologist (Apiculture)			9						
Associate Entomologist (Tropical & Subtropical In-			_						
		٠	1						
sects)			9						
			-	3					
Entomologist									
Entomologist (Insect Ecology)				5					
Senior Entomologist (Cercal & Forage Insects)					2				
Junior Physicist									
Assistant Silviculturist		7							



TABLE 10. (Continued)

Examinations Held in 1930, and Number of Appointees therefrom by Grades, From January 1, 1930, to May 31, 1931.

Silvieulturist	TITLE OF EXAMINATION		s	ALAF	RY GR	OUP		TAT
Taxation Economist		P-1	P-2	P-3	P-4	P-5	P-	- 6 E
Assistant Forest Economist (Crop & Livestock Forecasting 1 Assistant Agricultural Economist (Land Economies) 1 Assistant Agricultural Economist (Foreign Competition & Demand 2 Associate Agricultural Economist (Foreign Competition & Demand 3 Associate Agricultural Economist (Farm Management) 1 Associate Agricultural Economist (Farm Management) 1 Associate Agricultural Economist (Farm Management) 1 Associate Agricultural Economist (Foreign Competition & Demand) 1 Associate Agricultural Economist (Statistical Research) 1 Associate Agricultural Economist (Statistical Research) 2 Agricultural Economist (Statistical Research) 1 Agricultural Economist (Marketing) 1 Agricultural Economist (Marketing) 1 Agricultural Economist (Marketing) 1 Associate Agricultural Economist (Foreign Competition & Demand) 2 Assistant Warchouse Examiner (Sack Grain) 1 Associate Marketing Specialist (Livestock Market Reporter 2 Assistant Marketing Specialist (Meat Grader) 1 Associate Marketing Specialist (Bean Standardization) 2 Associate Marketing Specialist (Beaf Grade Supervisor) 3 Sociate Marketing Specialist (Beaf Grade Supervisor) 3 Sociate Marketing Specialist (Beaf Grade Supervisor) 4 Associate Marketing Specialist (Beaf Grade Supervisor) 4 Associate Principal Marketing Specialist (Divestock Marketing Specialist (Tobaceo) 4 Associate Principal Marketing Specialist (Tobaceo) 5 Associate Principal Marketing Specialist (Tobaceo) 5 Associate Principal Marketing Specialist (Tobaceo) 5 Associate Principal Market					2		٠.	9
Assistant Agricultural Economist (Crop & Livestock Forecasting					2			2
Forecasting 1 Assistant Agricultural Economist (Land Economies) 1 Assistant Agricultural Economist (Foreign Competition & Demand 2 Associate Agricultural Economist (Crop & Livestock Forecasting) 1 Associate Agricultural Economist (Farm Management) 1 Associate Agricultural Economist (Land Economies) 1 Associate Agricultural Economist (Foreign Competition & Demand) 1 Associate Agricultural Economist (Statistical Research) 1 Associate Agricultural Economist (Statistical Research) 1 Agricultural Economist (Statistical Research) 1 Agricultural Economist (Marketing) 1 Agricultural Economist (Marketing) 1 Associate Agricultural Economist (Foreign Competition & Demand) 1 Assistant Warehouse Evaminer (Cotton & Bulk) 3 Assistant Warehouse Examiner (Sack Grain) 1 Assistant Warehouse Examiner (Sack Grain) 1 Assistant Marketing Specialist (Livestock Market Reporter 2 Assistant Marketing Specialist (Meat Grader) 1 Assistant Marketing Specialist (Bean Standardization) 2 Associate Marketing Specialist (Beaf Grade Supervisor) 3 Marketing Specialist (Tobaceo) 4 Assistant Marketing Specialist (Beaf Grade Supervisor) 3 Marketing Specialist (Tobaceo) 4 Associate Marketing Specialist (Beaf Grade Supervisor) 3 Associate Marketing Specialist (Beaf Grade Supervisor) 3 Marketing Specialist (Tobaceo) 4 Associate Marketing Specialist (Beaf Grade Supervisor) 3 Associate Marketing Specialist (Beaf Grade Supervisor) 4 Associat			2	٠.		• •		9
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tion & Demand) Assistant Warchouse Examiner (Cotton & Bulk) 3 Assistant Warchouse Examiner (Sack Grain) 1 Associate Warchouse Examiner 1 Associate Warchouse Examiner 1 Assistant Marketing Specialist (Livestock Market Reporter 2 Assistant Marketing Specialist (Meat Grader) 1 Assistant Marketing Specialist (Fruits & Vegetables) 13 Associate Marketing Specialist (Bean Standardization) 2 Associate Marketing Specialist (Beef Grade Supervisor) 3 Marketing Specialist (Wool) 1 Marketing Specialist (Tobaceo) 4 Associate Marketing Specialist 1 Marketing Special						1		1
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Time was when extent of factual knowledge was the test of an educated man, but during recent decades factual information has so increased that now no man can be master of even a narrowly specialized field. Knowledge of the sources of information and how to use them is now indispensable. It is submitted that training in the art of acquiring such knowledge should be incorporated in the courses pursued by students preparing for federal employment.

Every entrant into the federal Professional Service must be regarded as a potential supervisor of assistants and in addition as a potential administrator. A prominent factor in an employee's advancement is his ability to win the cooperation of his subordinates and to weld them into a loyal and effective working unit. The individual who is "temperamental," who rules his subordinates with an iron hand, and is inconsiderate of their rights as fellow human beings, impairs his chances of advancement in addition to developing in his group a spirit of dissatisfaction and resentment that is incompatible with good service. Since this matter of human relations is one of importance to the individual, whether in or out of the federal service, it is suggested that provision be made in appropriate courses for at least some training in this particular field of endeavor.

Lack of knowledge concerning the purpose, functions, organization, and operation of the several branches of the federal government characterizes many of the entrants into the service. As a result of this lack the newcomer, particularly if just graduated from college, requires a certain period in which to adjust himself to his new surroundings and to acquire some familiarity with that orderly and systematic procedure in the conduct of government business popularly referred to as "rcd tape." The period of adjustment is often an unproductive one, during which the employce may become discouraged or dissatisfied. It is also a period of trial for the employee's supervisor, who perforce must act as instructor in the elementary principles of governmental organization and procedure. Moreover the advancement of an employee to positions of greater responsibility is seriously impeded if he fails to visualize himself as an integral part of the organization as a whole, and, as sometimes happens, develops an antagonistic attitude toward organized and orderly procedure. It is probable that the orientation



PERSONNEL IN AGRICULTURE

period of the new employee would be less painful and prolonged if before graduation he had pursued a course in the principles of public administration, or in the principles of federal administration. It is therefore recommended to this conference that action be taken in favor of the establishment of such courses generally. Students who pursue such courses may or may not enter the federal service but in either event they will be able more intelligently to meet the requirements of citizenship.



REPORT OF THE DIRECTOR OF PERSONNEL AND BUSINESS ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE, OFFICE OF PERSONNEL AND BUSINESS ADMINISTRATION, Washington, D. C., September 29, 1931,

Sin: I submit herewith a report of the work of the Office of Personnel and Business Administration for the fiscal year ended June 30, 1931.

Respectfully,

W. W. STOCKBERGER. Director.

Hon. ARTHUR M. HYDE, Secretary of Agriculture. .

INTRODUCTION

During the year the Office of Personnel and Business Administration exercised general supervision of the business operations of the department and its staff of 28.163 workers stationed in the District of Columbia and throughout the United States and foreign countries, and assisted in the preparation of a budget for which Congress appropriated \$349,246,090.

EMERGENCY WORK

The drought of 1930, together with the unemployment situation, placed new responsibilities upon each bureau and office of the department, requiring many new workers throughout the country and demanding overtime work by the department's permanent staff. The personnel responded to the occasion in the best of spirit.

HOUSING PROBLEMS

The Department of Agriculture occupied 3,100,569 square feet of office and laboratory floor space during 1931. Of this, 1,354,315 square feet was located in the District of Columbia; 429,140 square feet was used rent-free in Federal buildings outside of the District of Columbia; and 1,317,114 square feet was rented outside the District of Columbia at a total rental of \$745,692.

Near the beginning of the fiscal year the new administrative building, linking the east wing and the west wing of the Agricultural Building, was opened for occupancy and the Office of Personnel and Business Administration transferred a number of scattered offices into these new quarters. This made necessary certain rearrangements of the char, watch, and elevator forces.

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Soon after the beginning of the fiscal year the buildings in the square bounded by B and C Streets, Linworth Place and Thirteenth Street, were razed by the Treasury Department for erection of a new extensible building. It was necessary to move several offices of the department from buildings in that square and to find other quarters for them until the new building is ready for occupancy.

Now the office is busily engaged in matching available space to the requirements of future occupants, with particular attention to the needs for contacts between certain related units. The problem also involves vacating certain other buildings, now occupied by agricultural workers, which are scheduled to be razed in the early future to make way for construction of another building.

IMPORTANT PERSONNEL LEGISLATION

The Office of Personnel and Business Administration has been called on to adjust its practices in accordance with three important

First of these is the Brookhart act, amending the classification acts of personnel legislation. and rate of pay of a large percentage of the department's personnel. This bill automatically raised the rate of compensation of many workers, beginning two weeks after the opening of the 1931 fiscal year, and necessitated a considerable revision of both personnel and financial records. The salary adjustments on account of the Brookhart act affected 3,202 employees of the department and increased the annual operating cost of the department \$268,287. Congress appropriated \$151.529 additional funds to cover part of this increase and the department absorbed the remaining \$116,758.

Passage of the Saturday half-holiday act, giving freedom of one afternoon a week to all Government workers throughout the country, complicated several problems of administration for this office. Many questions concerning the effect of this legislation on annual and sick leave had to be decided. Also the office faced the necessard sick leave had to be decided. sity of deciding the manner in which this act should affect the 80 per cent of the personnel working in the field. Many workers are quartered at small stations, performing duties requiring regular

The retirement act as amended in 1930 provided retirement benedaily attention. fits for workers commensurate with their earning capacities during years of active service.

ORGANIZATION AND SCOPE

In 1925 the Secretary of Agriculture consolidated nine separate and independent business and personnel offices into the centralized Office of Personnel and Business Administration under the leadership of a director. It was the purpose of this centralization to eliminate confusion and waste in business procedure and to simplify and facilitate the general business administration of the department.

This office represents the department in dealing with the Civil Service Commission, the Personnel Classification Board, the Employees' Compensation Commission, the Bureau of the Budget, the





General Accounting Office, Veterans' Administration, and the various boards operating under the authority of the Chief Coordinator.

In personnel administration, organization, budget, and fiscal matters this office cooperates with bureau chiefs in effecting improvements. It purchases needed equipment and sells unnecessary materials. It solves transportation problems involved in official travel of members of the department and in transferring necessary supplies between headquarters and field. It provides suitable working quarters for the department and cares for the department's buildings and equipment.

The office is organized into two major units—the branch of per-

sonnel and the branch of business and fiscal operations.

BRANCH OF PERSONNEL

In the personnel branch there are a division of appointments and a division of organization and classification. The division of appointments is responsible for the personnel changes of the department in so far as changes are affected by civil-service rules, by administrative and fiscal regulations, or by decisions of the Comptroller General. The division has a complete service record of 28,163 employees. It maintains cumulative records of appointments, promotions, demotions, resignations, removals, retirements, leave, and furloughs withont pay. It assists in developing tests and examinations for appli-

cants for positions in the department.

The division of organization and classification handles requests for classification of the positions of departmental employees, according to the character of the work and the degree of responsibility involved, in so far as these positions are defined by the personnel classification act. It investigates appeals for reclassification and makes recommendations to the director for disposal of such appeals. It presents elassification cases before the Personnel Classification Board. It studies the organization of various bureaus, analyzes and describes bureau functions and considers proposed changes of departmental organizations, and the effects these changes will have on the personnel and on the effectiveness of departmental operation.

DIVISION OF APPOINTMENTS

At the close of the fiscal year, 28,163 persons were on the rolls of the Department of Agriculture, the greatest number of employees in the history of the department, according to records maintained in the division of appointments. In fact, the department personnel increased by 2.422 during the 12 months. At the close of the fiscal year, 2,924 more workers were performing agricultural service for the Federal Government than at the peak of activity during the World War.

The personnel requirements of the war-time period and of the past year have been similar inasmuch as both periods have embraced emergency work and have required abnormal numbers of workers. However, the requirements of the past year have not called for nearly so great an increase in staff as did those of the former period,



and the present personnel represents a rather steady growth of department service in response to the demands of the agricultural industry. Most of the present stuff is engaged in permanent and recurring work, whereas the war-time staff was reduced by more than 6,000 workers during the postwar period.

The department staff was divided as follows: 5,639 employees working in the District of Columbia; 22,446 working at 1,451 field stations scattered throughout the United States; and 78 stationed in

A normal turnover.—The department personnel has experienced a foreign countries. normal turnover.—The department personner has experienced at normal turnover of 7.95 per cent during the year, as compared with 9.79 per cent during the fiscal year of 1930, 8.62 per cent during 1929, and 9.50 per cent during 1928. To appreciate the present stability of the department personnel one need only compare these figures with the postwar turnover of 54.76 per cent in 1920 and 18.11

The department appointed 10,258 new employees during 1931. per cent in 1921. compared with 7,707 appointments the previous year. Separations from the service totaled 7,836, compared with 5,986 during 1930. The department promoted 5.335 workers, compared with 6,578 promotions

Record of leave.—Although it is commonly reported that Governin 1930. ment employees in Washington take 30 days of annual leave and 30 days of sick leave with pay, the records in the division of appointments do not bear out this report. During the last eight years men and women working for the Department of Agriculture in Washington took an average of 27 days annual leave and 7½ days sick leave, or altogether 341/2 days leave with pay each year. For the year 1931 the employees used only 6.9 days of sick leave on the

In the field, where most of the department's employees are located, average. the limit is 15 days annual leave and 15 days sick leave. However, few workers take leave to this extent. The combined average of annual and sick leave is 15.1 days during the last 8 years. Last year the average field employee used only 2.8 days of sick leave and

throughout the 8 years only 3 days each year.

It may surprise many to know that an average of 27 per cent of the employees in Washington and 53 per cent of the field force did not take any sick leave during the last 8 years. Furthermore, only 4 per cent of the Washington personnel and 5 per cent of the field personnel made use of the entire allowance of annual and sick leave which may be granted.

Work incident to appointment, transfer, and promotion.-The division of appointments was engaged throughout the year in duties incident to the appointment of new employees or the transfer or promotion of other workers. In fact, the necessity of additional personnel to carry out the emergency work anthorized by Congress occasioned a large volume of extra work by this staff.

This division requested 132 examinations to be given by the Civil Service Commission and received and circulated among the department administrators 253 applications for positions. The division



also obtained from the Civil Service Commission the following certificates and authorizations affecting personnel:

Reinstatement certificates	385
Prometion certificates	
Transfer certificates	289
Authorities for extensions of temporary appointments	
Authorities for extensions of suspensions.	

Retirement records.—In line with the duty of keeping retirement records of all employees in the department, the division has devoted considerable time and effort during the year to bringing this information up to date and at the same time has handled the usual number of retirements occurring during the year. Twelve extra workers were engaged on a temporary basis during the latter part of the year to compile data on the service of individual employees for the period since passage of the retirement act in 1920.

During the fiscal year the division disposed of 307 retirement cases as follows:

Annuity retirements: 36 professional; 88 subprofessional; 20 clerical, administrative, and fiscal; and 27 custodial employees.

Disability retirement: 7 professional; 17 subprofessional; 20 clerical, administrative, and fiscal; and 3 custodial employees.

The averages of the annuities in the various groups are as follows:

• *	0 1		
Professional and scientific	\$1,	660.	77
Subprofessional	****	926.	61
		907.	88
Custodial		7.19	19

Continuances in services after passing retirement age: 53 first continuance; 29 second continuance; 3 third continuance; 1 fourth continuance; 2 fifth continuance; and 1 sixth continuance.

Fifty-two persons who will reach retirement age during the first half of the coming fiscal year have already been reported for continuance. Many more will be retired during that period because of age or disability.

DIVISION OF ORGANIZATION AND CLASSIFICATION

The division of organization and classification was created on June 1, 1929. It is concerned with carrying out the provisions of the classification act of 1923 and subsequent amendments, which provide for the classification of Federal positions in the District of Columbia into various services and salary grades. This division is also concerned with the department's organization problems and the placement of individual employees in positions for which their training and experience best qualify them.

During the fiscal year this division handled 1.085 cases, of which 545 involved new positions, 430 involved changes of duty, and 110 were appeals from present classification.

The department personnel consists of approximately 28,000 employees, of whom 17,000 are permanent, full-time workers, and about 11,000 are engaged jointly by the department and by State governments or other cooperating agencies. The work of this staff is



roughly grouped into five classes: Research, service and regulatory, educational and informational, administrative and clerical, and mechanical and custodial.

The types of positions that this division is called upon to classify cover the full range of grades and services as defined by the classification act and its amendments. Among the professional grades alone, this division classifies 5.346 positions involving 189 distinct classes: it deals with a far greater number of positions of a wide variety in the subprofessional, clerical administrative fiscal and custodial grades. The positions thus classified vary from director, bureau chief, specialized scientist, and administrative worker to charwoman and laborer.

Varied activities of the department are such that the personnel represents practically all occupations in the classified Federal service. The technical positions group themselves generally into seven occupational fields: Economics, agriculture, biology and physical sciences; medical science; veterinacy science; legal group; library group; and engineering group.

Score of classification duties.—The division of organization and classification recommends the allocation of positions according to the character of work, difficulty involved, degree of responsibility, and qualifications necessary to perform the duties. It investigates appeals from existing classification and recommends appropriate action to the director.

The division represents the director before the Personnel Classification Board on all matters of personnel classification affecting this department. Classification requests received from the bureaus are first analyzed and investigated by this division, at which time an effort is made to coordinate each position with similar positions in this department and, in so far as possible, with similar positions in other departments. The division then assists the bureaus in preparing their job specifications in accordance with the requirements of the Personnel Classification Board. The division contacts representatives of the Personnel Classification Board and assists them in determining the correct grades in cases referred to them.

Recognizing that one's judgment can be no better than his information, the division has developed a file of pertinent information about department activities. This file assists both the division and the Personnel Classification Board in arriving at just decisions in their allocation of positions.

their allocation of positions.

Accomplishments.—Since its creation, the division has made an earnest endeavor to coordinate the positions in this department. Early in the fiscal year the division reviewed some of the more tangible accomplishments of a period of three months. This study showed that the coordination work and the incidental studies of organizations effected appreciable savings.

organizations effected appreciable savings.

In addition to actual monetary savings, the division has made some progress in its placement work. In many cases its recommendations have resulted in the shifting of employees into types of work which they were best qualified to perform.



The division has made a number of organizational studies, some at the request of the bureaus and some inaugurated by this division. In some instances these studies are still in progress, while others, already completed, have led to the creation of new divisions and the consolidation of activities. It is also conducting type-of-work studies for the purpose of developing uniform standards of work within certain classification grades. The object of these studies is to align all positions of like character in accordance with the standard established therefor.

In November, 1929, the division of organization and classification undertook the task of charting the entire personnel of the Department of Agriculture. By the end of June, 1931, it had prepared charts for about 400 units—preliminary or permanent charts for all of the department except the Office of Cooperative Extension Work and part of the Bureau of Agricultural Economics. These charts show the positions of more than 20,000 workers. The charts have been filed with the Secretary and with each bureau studied.

have been filed with the Secretary and with each burean studied.

The Personnel Classification Board has not been empowered to establish a classification system for field forces, but the department is applying the same system, in so far as possible, to both headquarters and field.

Incidental to the classification of personnel is the preparation of definitions of functions of each position in the department. The division carefully prepares detailed descriptions of bureau functions and functions of branches, divisions, sections, units, and individual employees in each bureau.

The division made considerable headway in preparing a Manual of Classification, which will be useful to employees in dealing with personnel and classification matters. It will treat the subject broadly, explaining what constitutes a classification scheme, outlining the history and jurisdiction of the Personnel Classification Board and discussing the development of a classification file, the writing of job specifications, and the administration of a classification and compensation plan.

BRANCH OF BUSINESS AND FISCAL OPERATIONS

The branch of business and fiscal operations, under the general supervision of the assistant director and budget officer, comprises the division of accounts and disbursements, the division of purchase, sales, and traffic, the division of operation, and the office of accounts for the office of the Secretary.

The assistant director and budget officer supervises the preparation of the department's estimates of financial needs and their presentation before the Bureau of the Budget and the Appropriation Committees of Congress and serves as the department's general contact officer with these agencies. He exercises general oversight over the business and fiscal affairs of the department. This involves the allotment and apportionment of appropriations, questions of general policy dealing with expenditures, legislation involving expenditure

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of funds, accounting or other procedure involving action by the General Accounting Office, and correspondence, reports to Congress,

and other such related matters.

The division of accounts and disbursements maintains the central departmental appropriation ledgers and records of receipts and expenditures, provides all bureaus with periodical statements of balances, and affords technical advice to the special temporary disbursing agents of the department. It includes the main disbursing office of the department wherein all funds are disbursed and all receipts collected for the department except those handled by the fiscal agents of the Forest Service and the special disbursing agents. This division also handles, in conjunction with the budget officer,

the compilation of the detailed estimates of appropriations.

The division of purchase, sales, and traffic coordinates the purchase, property, sales, and traffic work of the department. It solicits and accepts bids for the department's procurement of a large percentage of the department's material, supplies, and services, and supervises the operation of the department's central stores—the distributing point of supplies in the District of Columbia. It serves as a clearing house for the interchange of surplus property between bureaus and departments. Through the traffic section, it routes all departmental equipment and supplies in a manner affording the most economical transportation, estimates shipping costs where they are a factor in determining the lowest bid for material to be purchased, assists the personnel with its passenger-transportation problems, and provides freight and passenger rate information to the department's auditors.

The division of operation has charge of miscellaneous operating matters and includes the duties previously performed by the office of the chief clerk of the department, and the operation of the sections of mails and files, telegraph and telephone, the watch force engaged in guarding the buildings and grounds of the department, the cleaning and labor forces, and the mechanical shops of the department. The shops construct special scientific and other equipment used by the department, maintain the power plant and department gavage and perform a variety of other services.

department garage, and perform a variety of other services.

The office of accounts for the Office of the Secretary maintains the operating accounting records for the Office of the Secretary, the Extension Service, the Office of Experiment Stations, the Office of Information, and the Grain Futures Administration. These records are to be distinguished from the general departmental accounting records maintained in the division of accounts and

disbursements.

THE DEPARTMENT BUDGET

Total appropriations made for the Department of Agriculture for all purposes, for the fiscal year 1931, covered by this report, amounted to \$349,246,090. Appropriations thus far made for the fiscal year 1932, amount to \$247,283,130. It will be noted that funds appropriated for highway construction are well in excess of 50 per cent of the total appropriations for each year. The distribution of the appropriations for 1931 and 1932 is shown in the Table 1.

A. di	Fiscal y	mr
Activity	1931	1932
Regular bureau appropriations		
Office of the Secretary	81, 191, 100	54, 513, 015
Office of Information	1, 355, 827	1, 420, 961
1 ibrary	1667, 1917	110, 620
Office of Experiment Stations Extension Service Weather Bureau	4 (2, 434	399, 410
Marthur Durant	1, 685, 000	1, 719, 560
Durgon of Ania al Industry	4, 123, 280	4, 497, 720
Bureau of Animal Industry Bureau of Dairy Industry	15, 678, 110	16, 085, 195 796, 990
Bureau of Plant Industry	7.14, 135 5, 683, 599	5, 539, 235
Forest Service	14, 225, 650	14, 384, 620
Forest Service Burean of Chemistry and Soils	1, 809, 115	2, 177, 201
Bureau of Entomology	2, 703, 201	2, 863, 740
Bureau of Biological Survey Bureau of Public Roads	1, 961, 520	2, 229, 170
Bureau of Public Roads		179, 940
Biffeau of Agricultural Engineering	208, 400 450, 500	583, 840
Bureau of Agricultural Economics	6, 633, 643	7, 241, 136
Bureau of flome Economics	208, 356	246, 700
Plant Quarantine and Control Administration	3, 759, 163	3, 747, 930
Grain Futures Administration	172, 640	221, 180
Food and Drug Administration	1, 635, 585	1, 810, 228
Seed Ioan collections	90,315	125, 000
Total, regular bureau appropriations		67, 993, 694
Payments to States (exclusive of roads):		
Experiment stattons	4, 310, 000	4, 357, 000
Extension Service Cooperative forestry items 1	8, 742, 936	8, 746, 936
Cooperative forestry items 1		
Fire prevention on privately owned and State timberlands	1,700,000	1, 775, 000
Distribution of planting stock	93, 000	95, 000
National forest receipt funds Special items:	1, 015, 500	4, 015, 500
Mediterranean fruit fly	1,710,000	
Compensation for noncotton zones	675, 000	
Fighting forest fires (deficiency)	1 1170 000	
Compensation for noncotton zones Fighting forest fires (deficiency) Buildings at Madison, Wis., and Alameda, Calif	7 900, 000	± 800, 000
Emergeucy relief funds (exclusive of roads):	• •	
Loans	2 45, 000, 000	- 22, 000, 060
Construction, etc	799, 300	
Road funds.		
Emergency construction act		
Federal-aid highways (advances to States)	50, 000, 000	
National-forest highways	3, 000, 000	
Fire-protection forest roads and trails.	3, 000, 000	
Public-land highways Other road funds	- is, thoro, three	
Subaralaid bighways	2 100 000 000	2 125, 000, 000
Property of trails		- 12, 500, 000
Maint Vernan in moral highway		
Federal-aid highways Forest roads and trails Mount Vernon memorial highway Floo-brekef roads and bridges	- 1, 391, 935	
Total, road funds	245, 691, 935	137, 500, 000
Total, all purposes	349, 246, 090	247, 283, 130

Small amount used by Forest Service. # Available in 1931 and 1932

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Appropriations for drought and unemployment relief.—The appropriations listed in Table 1 include sums totaling over \$169,000,000 which were provided for 1931 or, if included in the 1932 appropriation act, were made immediately available upon passage of the act on account of drought and unemployment relief, as shown by the following tabulation:

Office of the Secretary:	
Changing from direct to alternating electric current in east and	
west wings of department building	\$23, 480
Repairs to elevators, east and west wings	60, 000



1() ANNUAL REPORTS OF DEPARTMENT OF AGRICULTURE

TOT MORICOLY	URE
Bureau of Animal Industry:	
vania filisbandry	
Clearing land for pasture development at Beltsville, Md Clearing and fencing land at Beltsville, Md	\$13, 495
Clearing and fencing land at Beltsville, Md Pas in c and water do stopping.	12, 500
	1=, 000
Cay, Mont Westock experiment station, Miles	
(in reased (acilities at Beltsville, Md., for poultry inves-	9, 000
Diseases of anomals: For construction of a laboratory at	10, 000
Bel'sville, Md., for the investigation of animal parasites Bureau f Darry Industry:	13, 000
Construction of a outrition laboratory at Beltsville, Md	
	25, 000
and countries and coulst incline of farm and below your last in	5, QQQ
The first of a water full electric systems and almost an in-	
The state of the s	-0.000
Construction of farm buildings at the Ardmore, S. Dak., dairy	***************************************
	5, 000
Construction work at the Woodward, Okla., dairy station Buream of Plant Industry:	2, 000
Construction, repair, and improvement of facul and laboratory	
on idings and other structures, road work grading are and	
101 other necessary installations in connection with field	
activities in various States	75, 000
Forest Service:	
Construction of fire protection roads and trails in the national	
Field work in controlling white-pine blister rust in the na-	3, 000, 000
te of forests of northern Idaho and adjacent portions of	
Mantana and Washington.	45, 000
Construction of southary facilities on national forests	10, 000
lime exements or actional forests (other than roads and trails)	
Co truction of maj rovements for the protection and adminis-	-194, 200
to the of the traineral ferests: Range improvements: com	
It in a insect infestitions on the national forests adjacent	
to the Yellowst he National Park and threatening the nark	
tuni and valuabo timber stands in northern Idaho	351 800
Compl. (on of construction of Forest Products Laboratory burlelings at Madiso , Wis	
Bur call of Biological Survey.	800, 000
Construction, repair, and improvement work of various kinds,	
and but surveying wild lite refuges, in connection with bird	
and came reservations and other field activities in the	
Wescan States and elsewhere; and control of injurious	
promiery animals and rodents Bureau of Public Redse	300, 000
Confidential distribution and maintenance of main roads through mappro-	
print I or unreserved public lands, nontaxable Indian	
trids, or other Federal reservations other than forest	
TO TAILTIONS	3, 000, 000
Alvar is of finds for a instruction of Federal aid highways, is obtained by deductions from future regular apportion-	
and the second s	50 000 000
Corseruction and improvement of highways within the bound-	80, 000, 000
trees of the national forests	3, 000, 000
Speeding up program of Federal-aid highway construction	, , , , , ,
cheeng part of \$31,000,000 supplemental appropriation for	
Fighway construction provided by the first deficiency act,	10 000
1931) Construction of buildings on Government Island, Alameda,	10, 000, 000
Calif., for accommodation of offices of Forest Service, Bureau	
of Public Roads, and Coast Guard	800, 000
Plant Quarautine and Control Administration:	,
Construction of a fumigation house at Presidio, Tex	35, 000



Seed Loan Office:

Loans to farmers in the drought, storm, and hail stricken areas of the United States, for the procurement of seed, fer tilizer, feed for work stock and for other livestock, and fuel

and oil for tractors used for crop production
Loans to individuals in the drought, storm, and half stricken
areas of the United States for the purpose of assisting in
forming local agricultural credit associations, livestock
loan companies, or like organizations or of increasing the capital stock of such organizations or of making tenss to capital stock of such organizations or of making leaves to individuals upon scentrity of the capital stock of such asganizations; and to make loans to farmers for crop production for the crop of 1931 and for nurther agricultural rehabilitation in the drought, storm, and hail stricken areas of the United States. Loans to farmers in the storm and drought stricken, reas of Alabama, North Carolina, South Carolina, Georgia, and Florida, for the crop year 1931, for purchase of scell tertilizer, feed for work stock, and fuel and cil for tractors used for crop production.

used for crop production____

Total

\$45,000,000

20, 600, 600

2, 000, 000

169, 172, 475

DIVISION OF ACCOUNTS AND DISBURSEMENTS

During the fiscal year of 1931 this division examined and paid 463,332 vonchers and pay rolls, amounting to 8243,784,041.96, and issued 728,031 checks on the Treasurer of the United States in payment thereof. From the regular appropriation provided by Congress, special-receipt funds and contributions from private cooperators, for salaries and expenses incurred in the general operation of the department and payments to the States for Federal aid road work, agricultural experiment stations and cooperative agricultural extension work, the amount disbursed was \$293,981,391. This involved the payment of 374,349 vonchers and pay rolls by issuing 648,205 checks. In addition this office issued 89,826 checks amounting to 89,799,650,96 in payment of 88,983 vonchers for emergencyvelief loans made to farmers in flood and drought stricken areas administered by the Washington regional seed loan effice. The remaining \$37.985.775.61 of loans which have been made was distributed directly by the seed loan office through its other regional branches

The semimonthly payments of salaries of employees stationed in Washington, included in the above total amount, involved the handling and disbursement of \$6,461,194.11 in each by this effice. average number of employees paid in cash each semimonthly pay day was over 4,000, making a total of about 100,000 individual cash pay-

ments for the 24 semimon bly pay days.

The disbursing clerk received from the various bureaus of the department and deposited in the Treasury collections of public moneys totaling \$4,859,221.94. These collections consisted of \$3,833,325.95 in repayments to appropriations and funds (principally repayments of storm and flood relief loans made to farmers in previous years); \$831,659,99 in miscellaneous revenues accraing from sales of Government property, services rendered the public, fees for the official inspection, grading or classification of commodities, and from other sources; and \$194.236 in contributious from private cooperators to defray in part the expenses of cooperative investigations in which they are interested.



These collections involved the receipt, handling, verification and posting of 7,445 schedules of collections, comprising a very much greater number of individual remittances, transmitted to this office by the various bureaus of the department, and the preparation of 841 certificates of deposit, transmission thereof to the Treasurer of the United States, and accounting therefor in the manner prescribed by the General Accounting Office.

Table 2 illustrates the steady growth of the work of the division of accounts and disbursements:

Table 2.—Vouchers paid and checks drawn by the division of accounts and disbursements, fiscal years 1926 to 1931

Fiscal year	Vouchers paid	Checks drawn	Fiscal year	Vonchers paid	Checks drawn
1926 1927 1928	Number - 242, 951 254, 744 1 267, 143	Number 337, 292 410, 521 1 441, 025	1929 1930 1931	Number 292, 947 333, 059 374, 349	Number 473, 384 546, 145 2 648, 205

¹ Exclusive of 215,000 vouchers paid and a like number of checks issued in connection with the campaign for control of the European corn borer.

² Exclusive of 89,000 vouchers paid and a like number of checks issued in connection with emergency drought relief and rehabilitation loans to farmers.

Aside from the large amount of extra work devolving on the disbursing office during the fiscal year 1931 in making payments to farmers for the emergency drought relief and rehabilitation loans, the number of vouchers and pay rolls paid in connection with the regular activities of the department exceeded that for the preceding year by 41,290 and the number of checks drawn was 102,060 greater than in the fiscal year 1930, an average increase of over 3,400 vouchers and over 8,500 checks per month.

OFFICE OF ACCOUNTS (OFFICE OF THE SECRETARY)

The office of accounts performs the accounting work and maintains financial records for the Office of the Secretary, the Extension Service, the Office of Experiment Stations, the Office of Information, and the Grain Futures Administration. It also makes the administrative examination of the accounts of the insular experiment stations and exercises supervision over the insular disbursing agents.

During the year the office audited 21,661 vouchers for expenditures aggregating \$24,800,259.97, which constituted funds appropriated for the above-mentioned units of the Department of Agriculture. However, the office had either direct or indirect control over the accounting for expenditures of \$39,806,298.15, of which \$15,006,038.18 was provided by States as extension funds to supplement Federal funds of like kind.

Accounting methods.—The office of accounts uses an accounting system developed jointly by the chief accountant, the Institute for Government Research, and the General Accounting Office. By adoption and standardization by the General Accounting Office, this system has become the uniform system prescribed for all Government agencies. Its subsequent adaptation to flat-bed bookkeeping-machine



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operation has enabled the accounting office to handle a greatly expanded volume of business with but slight increase in force.

By use of the electrical pay roll machine of the stencil type it is possible to produce pay rolls of the Secretary's Office at the rate of 1,400 impressions an hour, while the same stencils prepare in duplicate the individual cash payments inserted in the disbursing clerk's pay envelopes and record payments on the individual salary-record cards maintained for each employee.

DIVISION OF PURCHASE, SALES, AND TRAFFIC

For many years a board of awards served as the department's principal purchasing agency. This board consisted of the department chief clerk, who was chairman, and two administrative officers from the bureaus. It passed on all proposals for the purchase of supplies not included in the general supply-committee contracts. Field officers or other bureau officers purchased all field supplies.

In 1921 the Federal Government created the Federal Purchasing Board, Federal Specifications Board, and Federal Traffic Board, with membership made up of various department representatives, and at the same time required each department to coordinate all of its purchase, property, and traffic activities. The Department of Agriculture soon consolidated these activities in one unit and in 1925 designated it as the division of purchase, sales, and traffic within the Office of Personnel and Business Administration. Two years later the office of the property clerk and purchasing agent of the Office of the Secretary also became a part of this division.

The chief of the division is the contracting or awarding officer of the department. The division is concerned with matters pertaining to purchases, supplies, traffic, and disposition of the department's surplus products.

Extensive purchases.—The division solicited and accepted 4,456 bids during the year. This work has steadily expanded from 1,614 bids in 1925 to the present figure, the largest in the history of this division. The flow of bid work during the year is far from uniform, partly because of the irregularity of seasonal work. About 40 per cent of these bids were rushed through the division during the last quarter of the fiscal year.

The division approved 150 bureau purchase orders, each in excess of \$500, for an aggregate expenditure of more than \$200,000 during the year and also solicited and accepted bids for many other large bureau purchases. Forest-road contracts to the extent of \$6,500,000, all requiring the Secretary's signature, first passed through this division for inspection. The division purchased \$1,300,000 worth of road-building equipment for the Forest Service during the four months beginning with December. Much of this was rush work incident to the national unemployment-relief program and added to the burden of the division's growing bid work. The General Supply Committee made definite-quantity purchases on quarterly contracts for \$100,000 worth of tires and tubes and \$22,358 worth of supplies in common use.

Estimates for 1932 automobile purchases.—The division compiled the annual estimate of the department's needs for passenger vehicles



during the fiscal year 1932 and obtained for the department an authorization to spend \$225,000 for purchase of about 170 new cars. About 90 per cent of the department's automobile purchases are

within the low-price field.

Surplus-property transfers.—The division has performed a considerable service this year as a clearing house for all surplus property within the department and for the interchange of surplus property between this and other departments. When field property is no longer needed by the Department of Agriculture, this division reports it to the chief coordinator for advertisement to other departments. During the first 11 months of the fiscal year the Department of $\Lambda {
m gri}$ culture received from other departments property currently valued at \$51,341.32, and released to other departments surplus property valued at \$158,032,87. This reverses the ordinary belance of exchange, since the Department of Agriculture usually receives more in these annual interdepartmental transfers than its contributes.

Office of the traffic manager. The office of the traffic manager promotes the efficient and economic operation of all the department's transportation of both personnel and property. During 1931 the office supplied freight-rate information for 2,106 shipments. Most of this came from the Federal Traffic Board. The office also obtained from the Federal Traflic Board routings of 57 shipments, each in excess of 2 carloads, and routed on its own authority 32 carload

shipments and 1.335 lesser shipments.

The traffic office handled more than two and one-half times as many freight-rate computations during the year as in 1930 and more than fourteen times as many as in 1928. The office also supplied department personnel with passenger and Pullman rates for 495, trips. This office has charge of distribution of all transportation-request

forms for use of the department's employees.

Central stores.—During the fiscal year the central stores distribatted \$211,725.11 worth of supplies to various offices and bureaus of the department, as contrasted with a distribution of only \$26,595 worth of property seven years earlier. The work of this unit has increased steadily year after year since its establishment. And while the value of supplies has trebled within the last six years, the central stores handled the greater volume with only 22 per cent more purchase orders. The central stores unit procures and distributes all supplies for the Office of the Secretary and for the addressing. duplicating, and mailing section and the illustrations section within the Office of Information, serves as a general supply office for the Bureau of Entomology, the Grain Futures Administration, the Burean of Dairy Industry, Burean of Agricultural Engineering, the Bureau of Home Economics, and the Washington forces of the Bureau of Agricultural Economics, and procures definite-quantity supplies for the remainder of the bureaus. It also serves the insular experiment stations by purchasing all of their supplies made in the continental United States. It maintains all property records of the Office of the Secretary, the Grain Futures Administration, and the insular experiment stations.

Central supply service.—It will be seen that despite the fact that the various bureaus and offices of the department in Washington have heretofore been scattered over a large area, it has been found

possible and economical during recent years to effect a considerable concentration of our service of supply in the central stores unit of

the division of purchase, sales, and traffic.

With the bringing together of the Washington offices of the department virtually into one building, now contemplated by the building program, the maintenance of numerous individual bureau and office storerooms for common supplies will not be accessary or justifiable, and it is planned, therefore, to provide a complete central supply and shipping and receiving service to meet all of the needs of the department, provided suitable legislative and fiscal anthorization can be obtained to make such operation possible on a basis of assured efficient service. The Comptroller General has held that the present legislative authorization of the department is not sufficient, in his opinion, for continuing, on the present basis of operation, the maintenance of a general storeroom for resale of supplies to the bureaus, but the department has been allowed until June 30, 1932, to secure an anthorization which will be deemed adequate by the Comptroller. It is planned to seek such authorization from Congress, and in view of the obvious advantages of this centralized handling of the supply service, it is hoped that it will be granted.

Department store.—The division sold \$40.637.64 worth of perishable products resulting from the department's experimental work in and near Washington. These sales were made in the department

store.

Representing department on coordinating boards.—The chief of the division represents the department on the Federal Purchasing Board, the Federal Specifications Board, and the Federal Standard Stock Catalogne Board. The traffic manager represents the department on the Federal Traffic Board. These interdepartmental boards were particularly active this year performing work which does not occur every year. The Federal Specification Board is now revising the existing Federal specifications, numbering more than 700. The purchasing board is conducting many commodity studies. The catalogue board is preparing a general catalogue of all items of property in use in the Federal service. Many of the department's representatives on the technical subcommittees of the specifications and purchasing boards have rendered valuable assistance in this work.

DIVISION OF OPERATION

The division of operation was organized February 6, 1931, by combining and realigning several of the units formerly included in the chief clerk's office. The new division comprises the mechanical shops, central labor and char forces, the department's telephone and telegraph section, the watch force, the Secretary's file room and the department post office. The chief of the division also supervises budgets and expenditures and the personnel activities of the Office of the Secretary.

During the year this division has inaugurated three special projects, reroofing of the east and west wings of the Agricultural Building, remodeling of the elevator equipment in those wings, and conversion of the electric current of those wings from direct to alternating current uniform with the current in the new administration unit. The



elevator-remodeling program includes a plan to speed up the passenger cars and to install safety devices and new inclosure fronts. Although the electric-current change over has been started, it will

not be completed for several months.

Greater telegraph and telephone service.—The volume of telegraph and telephone traffic continued its rapid rate of increase during the year. The telegraph and telephone section installed 202 new telephone stations during the year, increasing the total number from 1,510 to 1,712, or 13.3 per cent. Telephone operators handled 2,562,-596 calls during the year, according to an estimate based on traffic tests at various times during the year. This was about 13.2 per cent greater traffic than in 1930. Of this number, 1,484,145 were branchto-branch calls.

To meet this increase of telephone business the section has added a new operator, installed numerous direct lines to other departments, compiled and distributed a 56-page telephone directory, and substituted the call-by-number system for the previous plan of calling by The favorable response of the department personnel has paved the way for the change from manual to antomatic operation,

which will take place probably within the ensuing year.

The telegraph and telephone section also handled 61,035 incoming and outgoing telegrams, an increase of 19 per cent over the previous year. These telegrams averaged about 33 words each. The staff actually checked and audited 122.821 messages, including many tele-. grams passing through branch stations, at a total cost of \$74.830.94. A tendency of various officers of the department to file most of their messages between 3.30 and 4.30 p. m. causes a congestion and a certain amount of delay in this emergency work, no matter how much the telegraph and telephone section attempts to handle them promptly. It is impracticable for the department to employ sufficient personnel to provide for this limited peak period and the earlier filing of messages is necessary for effective service.

Improved mail service.—Upon the organization of the division of operation, the department post office was placed under the direction of the officer in charge of the Secretary's file room. This change

has materially improved the efficiency of the mail service.

Char and watch duties complicated.—The cleaning force has kept its work up to standard in the administration building, where corridors were crowded with temporary drought-relief workers, only by introducing improved methods and working more efficiently, During the year many personnel units have moved to new quarters and the labor force has assisted in its customary way with this change.

During the year the department has occupied several additional buildings in widely scattered locations, thereby increasing the duties of the watch force in guarding buildings. By doubling assignments, the watch force has been able to guard the extra buildings. The division of operation has made a tentative provision for increasing the amount of compensatory time allowed members of the watch force for Sunday service, thereby establishing the workers more nearly on a basis comparable with that of other departments.

Mechanical shops.—The mechanical shops were organized for the purpose of assisting the department's scientists in the construction of laboratory apparatus, maintaining the buildings in condition suitable for the best work, and providing certain other services. As one of their chief functions, the shops construct intricate scientific devices, many of which could be obtained only with difficulty and

at great expense in commercial fields.

Among the most interesting pieces of apparatus constructed in the shops are two propagating boxes, one designed to be dismantled for convenience in shipping, and both employing a circulating-water temperature-control system built into the walls. The shops also designed and built some metal plant-growing chambers in which light, atmospheric pressure, humidity, temperature, and carbon-dioxide are under control. As another outstanding example of the skilled work required of the mechanical shops each year, the staff constructed a 10-compartment cabinet with independent thermostatic control over each separate compartment and the autómatic stirring of the contents of 8 compartments during 2 minutes out of every 10 minutes. The stirring occurs progressively from compartment 2 to compartment 9.

As one of its regular activities, the shops completely outfitted eight new laboratories and made alterations in several others. They operated refrigeration plants for the bureans in accordance with the exacting requirements of experimentation. In one instance, they maintained several thousand cans of vegetables in refrigeration at the correct temperature continuously for nine months, with never

a deviation.

In addition to these services, the staff of workmen skilled in various trades also engages in a variety of activities, such as painting, plumbing, electrical work, repairing motor cars and trucks, operating a motor-transportation service, repairing typewriters, making awnings and rubber stamps, and maintaining and operating the

department's elevators.

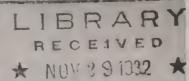
The total work performed by the mechanical shops during the year represented the gross expenditure of \$367,363. This compares with the previous year's expenditures of \$339,982, or an increase of 8.1 per cent. Of these amounts, \$227,487 and \$210,469, respectively, represent reimbursable work performed for the bureaus and offices during the 1931 and 1930 fiscal years, or an increase of 8.1 per cent in 1931. The reimbursable work involved 13,861 shop requests, an

increase of 17 per cent over the previous year.

Real estate and housing.—The Department of Agriculture occupies 58 buildings within the District of Columbia. The Federal Government owns 40 of these and the department rents the remaining 18 privately owned buildings. During the year the department paid \$133,945 for rental, while another governmental agency paid for the rental of the building occupied by the Plant Quarantine and Control Administration. The individual rentals range from \$35,000 a year for an 8-story building on F Street NW. to \$330 a year for one office room on the same street.

A statement of the space occupied by various units of the Department of Agriculture in the United States and its possessions and the annual expenditure for rented space is shown in Table 3.





REPORT OF THE DIRECTOR OF PERSONNEL AND A price to BUSINESS ADMINISTRATION

United States Department of Agriculture, Office of Personnel and Business Administration, Washington, D. C., September 6, 1932.

Sir: I submit herewith a report of the work of the Office of Personnel and Business Administration for the fiscal year ended June 30, 1932.

Respectfully,

W. W. STOCKBERGER, Director.

Hon. Arthur M. Hyde,
. Secretary of Agriculture.

INTRODUCTION

From the standpoint of administration, the fiscal year 1932, was marked by measures of economy in order to bring the expenditure program of the department into conformity with the general financial situation of the Government. At the beginning of the fiscal year the chiefs of the several burcaus and offices were requested to curtail expenses in every possible manner in order to lighten the burden upon the Treasury and reduce the size of the deficit. By administrative economies of all types, reduction in salary expenditures through the nonfilling of vacancies, the elimination of increases in compensation, reduction of expenditures for travel, both as to the amount performed and the rate of travel expenses paid, purchase of supplies and equipment, and by curtailment and post-ponement of activities where possible, a considerable reduction in anticipated expenditures was effected, and the following amounts, approximately, were not used and will be returned to the Treasury as outright savings from the appropriations for the ordinary activities of the department:

Bureau of Agricultural Economics Bureau of Agricultural Engineering Bureau of Animal Industry Bureau of Biological Survey	926, 840	Grain Futures Administration. Bureau of Home Economics Office of Information Library	16, 750
Bureau of Chemistry and Soils	194, 300	Bureau of Plant Industry	344, 850
Collection of seed loans		Plant Quarantine and Control Adminis-	
Bureau of Dairy Industry		tration.	409, 370
Bureau of Entomology	375, 060 29, 130	Bureau of Public Roads Office of Secretary	
Office of Experiment Stations Extension Service		Weather Bureau	
Food and Drug Administration	105, 370	Weather Dureau	330, 770
Forest Service	680, 110	Total	4 665 200

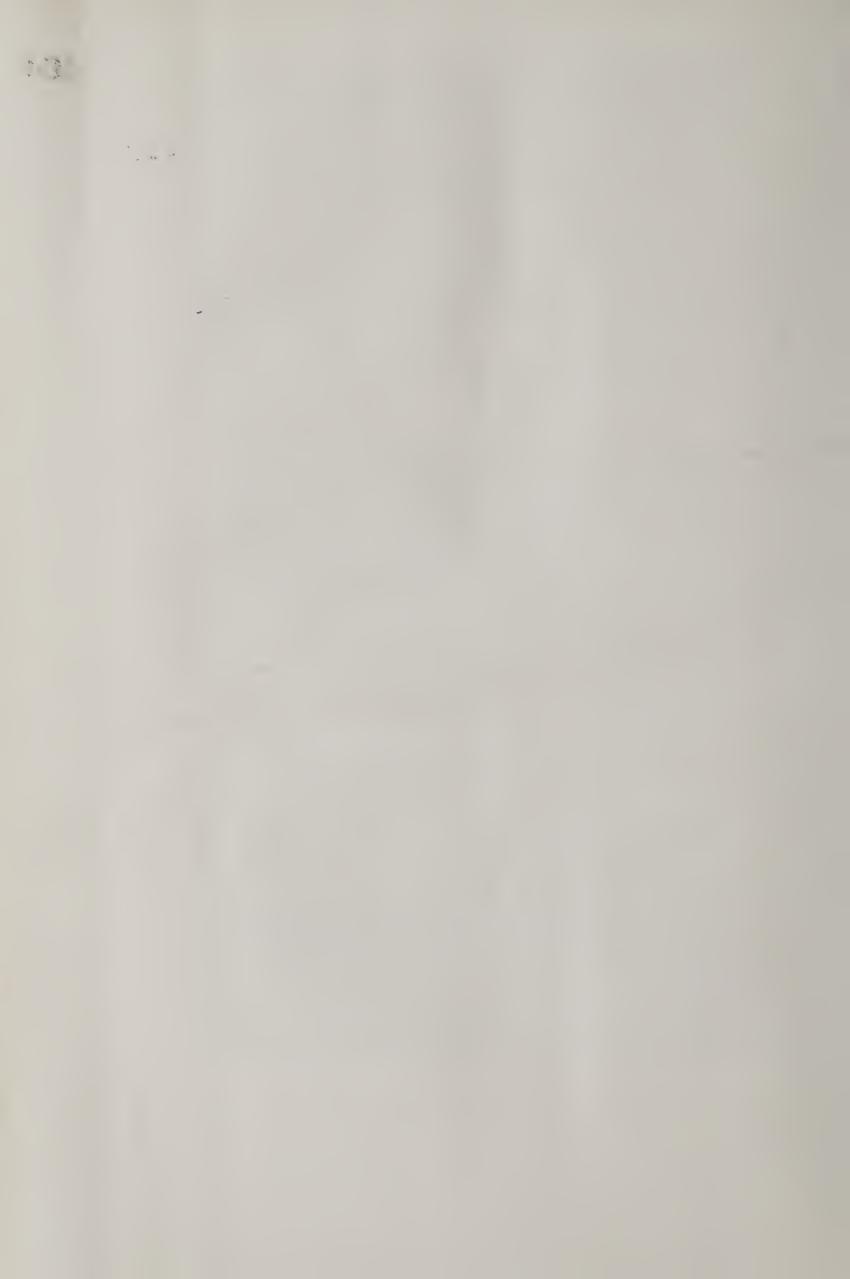
In addition to the foregoing savings from the appropriations for ordinary activities, unexpended balances amounting to approximately \$7,902,000 accrued on special appropriations for loans, roads, etc., which also will be returned to the Treasury.

Treasury.

The savings of \$4,665,200 effected on the appropriations for ordinary activities were in almost every case reflected in decreased appropriations for the fiscal year 1933, and white their accomplishment necessitated considerable rearrangement of expenditure plans throughout the department and created a difficult situation during 1932, at the same time the department was able to meet the situation arising in the fiscal year 1933 when reductions approximating \$10,000,000 were made in these appropriations with less disturbance to the work than otherwise would have been the case.

In addition to the administrative action taken in the department to curtail expenditures, Congress devoted considerable attention to legislation dealing with the same subject. As an outgrowth of both the executive and legislative acts, therefore, numerous problems of business and personnel administration arose, and the retrenchment plans and policies thus determined upon placed greatly added

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duties on all offices in the department, both in the central administration and the several bureaus and offices. The reduction in appropriations and the passage of the economy act (Public, No. 212, 72d Cong.), approved June 30, 1932, enacted to accomplish savings in the conduct of the entire Government, placed further restrictions on departmental operation which will have a decided effect throughout the fiscal year 1933.

For the purpose of clarity, the work of the Office of Personnel and Business Administration is developed according to individual divisions, as follows:

BRANCH OF PERSONNEL

DIVISION OF APPOINTMENTS

The division of appointments continued to function along the same lines as indicated in last year's report. In view of the conservative policy adopted by the department in making appointments and filling vacancies since the last report, the records of this office reflect interesting information which may best be observed through the comparison shown in Table 1.

Table 1.—Personnel activities of the Department of Agriculture, 1931 and 1932

Year ended June 30	Employee	es on rolls o	of depart-	Field stations	Employ- ees ap- pointed	Separa- tions from the depart- ment
	Depart- mental service	Field service	Total			
1931 1932	5, 639 5, 664	22, 524 21, 764	28, 163 27, 350	1, 451 1, 451	10, 258 6, 612	7, 836 7, 425

The department personnel experienced a turnover of 5.98 per cent during the year as compared with 7.95 per cent during 1931, 9.79 per cent during 1930, and 8.62 per cent during 1929.

During the year, 304 formal applications for positions were received in 1 circulated throughout the department.

RECORD OF LEAVE

Comparison of the average number of days leave taken by the employees of the department during the calendar years 1924 to 1931, both inclusive, is shown in Table 2.

Table 2.—Average number of days leave taken by employees of the Department of Agriculture, 1924-1931

DEPARTMENTAL EMPLOYEES

		•							
Leave	192‡	1925	1926	1927	1928	1929	1930	1.43	s frans iconico
Annual Sick	27, 0 7 6	27. 3 7. 3	27 2 7. 9	27. 0 7 5 34. 5	27. 0 7. 7 34. 7	27 0 7 7 31 7	27 0 6, 9 -	27 2	27 1
Total	31 6	34 6 FIELI		TOX EE					
Annual	12. 1 3. 0	12. 3 . 3. 0	12. 2 3. 2	12. 0 3. 0	12.0	12. 3) 3. 1	12.3 2.5	12 6 2 8	12 2
Total	15. 1	15. 3	15, 4	15. 0	15.3	15. 4	15, 1	15 \$	15.2

Employees in the field service, until June 30, 1932, were limited to 15 days annual and 15 days siek leave. By act of Congress (Public No. 212, 72d Cong.) the privilege of receiving annual leave with pay was suspended during the fiscal year ending June 30, 1933.

301 dist.



It is interesting to note that 26 per cent of the employees in Washington and 54 per cent of the employees in the field took no sick leave in 1931, and only 4.1 per cent of the Washington personnel and 4.1 per cent of the field used the entire allowance of annual and sick leave which could have been granted. These averages are consistent with those of the past eight years.

WORK INCIDENT TO APPOINTMENTS, TRANSFER, AND PROMOTION

Personnel changes in the department during the year, as compared with those of 1931, are given in Table 3.

Table 3.—Personnel changes in the Department of Agriculture, 1931 and 1932

•	1931	1932
Certificates from registers	1, 420	702
Reinstatement eertificates	385	212
Certificates for change in status.	619	194
Transfer certificates	289	165
Authorities for temporary appointments	762	462
Authorities for extensions of temporary appointments		443
Authorities for extensions of suspensions	[1]	6
Civil Service examinations requested.	132	26

RETIREMENT RECORDS

The division of appointments has continued work on the final completion and installation of a new system of retirement records, which was begun in the fiscal year 1931, under which Civil Service Form 2806 was substituted for the old master retirement card. All applications for retirement, except disability, are now submitted to the Civil Service Commission with complete fiscal and permitted to the Form 2806. Fig. r. decides referred to 1931 and 1932 are given in Table 4.

Table 4.—Number of employees retired, 1931 and 1932

	Annu	ty retire	ments m	clas =	Disah i	ty refire		class	
Year ended June 30	Profes sional	Subpro fe - sional	Clerical, admin- istra- tive, and fiscal	Cus- todial	Profes stored	fes-	Cler cal, admin- istra- tive, and fiscal	Cus- todial	Cases dis- posed of
1 31	36	11	20 13	27 4	*	17	20	3 10	307 378

The averages of the annuities in the various groups are as follows:

		1931	1932
Professional and scientific		\$1,006,77	\$1, 100, 77
Subprefessional		926, 61	972, 67
Clerical, a limini, trative, and fiscal		907 88	951, 58
Custo tol		749-42	695. 57

Of 157 employees on continuance at the close of the fiscal year only 3 were recommended for further continuance, the remaining 154 employees being separated from the service effective hanc 30, 1932, under the terms of the economy act. The number of employees who had been given continuances in 1931 and 1932 is shown in Table 5.

Table 5.—Number of employees who received continuances after reaching retirement age, 1931 and 1932

Year ended June 39		Extensions					
		Second	Third	Fourth	Fifth	Sixth	
1931	53 60	29 35	3 1	1 0	2 0	1 0	

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The proportionate number of employees reaching retirement age apparently will continue at about the same rate during the fiscal year 1933, but under the terms of the economy act it appears that almost all these employees will be recommended for retirement and very few for continuance.

DIVISION OF ORGANIZATION AND CLASSIFICATION

The division of organization and classification continued with no charge to the division of organization and class heation continued with no charge its staff since the last report. A number of important investigations were concluded by this division, which resulted in the reorganization of bread work and a saving in money to the department. With a departmental economy program in effect this office has been particularly useful in assembling information concerning organizational and classification matters. Since the last report was said the number of positions allocated has been substantially reduced, as will be noted in Table 6.

Table 6. - Appointments and changes in status of employers of the Department of Agriculture, 1931 and 19.

Year en ied June 30	Appoint ments to rew positions	Changes in dury	17.1.16	Allera	1 1 1 1 1 1
1931	15.	‡) 3	47 721	1+ 23	1 _

During the year this office drafted and had photographed 151 charts covering

the various bureau activities of the department. This number does not me almiscellaneous charts prepared from time to time to accompany special report.

The scope of activities of this division continues similar to that outly defined year's report, with the exception that a new house organ, the Administrative Bulletin, has been edited by this office. The Bulletin is a departmental and the time reflecting constructive information for the use of administrative of the field constructive information for the use of administrative of the manufacture and in the field construction. Washington and in the field service.

BRANCH OF BUSINESS AND FISCAL OPERATIONS THE DEPARTMENT BUDGET

Total appropriations made for the Department of Agriculture for all purpoles for the fiscal year 1932, amounted to \$301,552,230. Appropriations thus far made for the fiscal year 1933 amount to \$185,883,236. The total for 1933 is exclusive of \$132,000,000 provided by the emergency relief and construction act of 1932 for advances to the States for Federal-aid and for other road construction during the fiscal year 1933. The distribution of the appropriations for 1932 and 1933 is shown in Table 7. It will be noted that funds appropriated for highway construction are well in excess of 50 per cent of the total appropriations for each year.

Table 7.- Distribution of Department of Agriculture appropriations for fixed years 1932 and 1933

[1932, final figures; 1933, as of July 1, 1932].

	*	Fi. cal	year
	Activity	1932	1933
Office Librar Office Exten Weath Burea Burea	ctivities: of the Secretary of Information cy of Experiment Stations (exclusive of payments to States) sion Service (exclusive of payments to States) her Burcan ur of Animal Industry u of Dairy Industry u of Plant Industry	110, 620 3''9, 410 1, 793, .60 4, 4'7, 720 16, 085, 195 796, 990	\$1, 206, 547 1, 335, 800 106, 106 291, 2-4 1, 688, 170 4, 164, 035 15, 324, 947 717, 448 4, 930, 874



Table 7.—Distribution of Department of Agriculture appropriations for fiscal years 1932 and 1933—Continued

Antivitus	Fiscal year		
Activity	1932	1933	
General activities—Continued.			
Forest Service (exclusive of forest roads, payments to States, and forest-			
ure denciency)	1 \$16, 960, 120	1 \$12, 556, 399	
Bureau of Chemistry and Soils	2, 177, 201	2, 025, 080	
Bureau of Entomology	2, 863, 740	2, 471, 700	
Bureau of Biological Survey	2, 229, 170	1, 756, 177	
Bureau of Public Roads (exclusive of Federal-aid highways)	179, 940		
Bureau of Agricultural Engineering	783, 840	518, 690	
Bureau of Agricultural Economics Bureau of Home Economics.	7, 241, 136	6, 649, 841	
Bureau of Plant Quarentine	216, 700	233, 365	
Burean of Plant Quarantine. Grain Futures Administration.	3, 747, 930	2, 490, 125	
Food and Drug Administration	221, 480	218, 538	
Food and Drug Administration	1, \$10, 228	1, 716, 167	
Total	70, 527, 294	60, 404, 600	
Payments to States (exclusive of road funds):			
State agricultural experiment stations, for research under Hatch, Adams,		İ	
and Purnell Acts (Office of Experiment Stations)	4, 357, 000	4, 374, 000	
State colleges of agriculture, for extension work, under Smith-Lever, and	1	, , , , , , , ,	
supplemental acts (Extension Service)	8, 672, 936	8, 728, 096	
Cooperative fire protection (Forest Service)	1, 775, 600	1,611,580	
Cooperative distribution of forest planting stock (Forest Service)	95,000	79,960	
Payments to States from national-forest receipts (Forest Service)	1, 640, 000	1, 280, 000	
Total	16, 539, 936	16, 073, 636	
Road funds:			
Federal-aid highways	175, 600, 000	100, 000, 000	
Forest roads and trails, under Federal highway act	12, 100, 000	8, 905, 000	
Roads and trails for States, paid from national-forest receipts	600,000	500, 000	
TOWNS AND TO THE TOWN WHITE THE TOWN THE TEXT THE TEXT TOWN	4,10,000		
Total	188, 100, 000	109, 405, 000	
Emergency relief loans:			
Loans to farmers in storm and drought-stricken areas, Southeastern States.	2, 000, 000		
Agricultural credit and rehabilitation emergency relief loans (carried in			
Interior Department appropriation act, 1932)	20, 000, 000	(2)	
Collection of seed loans	125, 000	(3)	
Total	22, 125, 000		
Special items:			
Fighting forest fires (deficiency item)	4, 260, 000		
Private claims and relief act	2, 145		
4 14 MIC CIMMO WILL FURTHER PROPERTY OF THE PR	-, 110		
Grand total	301, 554, 375	4 185, 883, 236	
C15 MAN - 0.0 MAT - 6.2 - 0.0 MAT - 8.2 MAT -	002,002,010	100,000,00	

1 Includes \$1,760,000 for cooperative work.

2 \$10,000,000 of 1932 appropriation provided by Public Resolution 11 of Mar. 3, 1932, reappropriated and made immediately available for aid in establishing agricultural-credit corporations.

3 \$2.00,000 of unexpended balance of appropriation provided under Public Resolution 114, approved Jan.

15, 1931, continued available until June 30, 1933.

4 Exclusive of \$1,000,000 carried in the agriculture act for 1933 for the Century of Progress Exposition, to be administered by the Chicago World's Pair Centennial Commission.

APPROPRIATIONS FOR ROAD CONSTRUCTION UNDER THE EMERGENCY RELIEF AND CONSTRUCTION ACT OF 1932

In addition to the appropriations listed in Table 7, the emergency relief and construction act of 1932 (Public No. 302, 72d Cong.), approved July 21, 1932, provided \$132,000,000 for emergency road construction during the fiscal year 1933 under the supervision of the Department of Agriculture, as follows:

Federal-aid highways (advances to States)	\$120,000,000
National-forest highways	5, 000, 000
National-forest protection and administration roads, trails, and	
other improvements	5, 000, 000
Public-land highways	2, 000, 000
	100 000 000
Total	132, 000, 000



DIVISION OF ACCOUNTS AND DISBURSEMENTS

During the year this division disbursed \$263,335,639.29, which required the examination and payment of 393,480 vouchers and pay rolls and the issue of 658,338 checks drawn on the Treasurer of the United States. As compared with the preceding fiscal year, this indicates an increase of \$19,554,597.33 in the amount disbursed, but a decrease of 69,852 vouchers and pay rolls examined and paid, and a decrease of 79,693 checks issued. The figures reported for 1931 included disbursements of \$9,799,650.96 for emergency-relief loans made to farmers in flood and drought-stricken areas administered by the Washington regional seed loan office, involving the payment of \$8,983 vouchers and the issue regional seed loan office, involving the payment of 88,983 vouchers and the issue of 89,826 checks, whereas during 1932 the number and amount of such payments were negligible. Eliminating, for purposes of comparison, these emergency-relief loan transactions from the 1931 totals, the disbursements were \$29,354,248.29 greater in 1932 than in the previous year, the number of vouchers and pay rolls increased by 19,131, and the number of checks issued increased by 10,133.

The large increase in disbursements was due almost entirely to the augmented appropriations available during 1931 for advances to States for Federal-aid

highway construction.

A comparison of the number of vouchers paid and checks drawn with the number in other years is shown in Table 8.

Table 8.—Number of vouchers paid and checks drawn, fiscal years 1927-193?

Fiscal year	Vouchers paid	Checks drawn	Fiscal year	Vouchers paid	Checks drawn
1927	254, 744	410, 521	1930.	333, 059	546, 145
1928	1 267, 143	1 441, 025	1931	2 374, 349	2 648, 205
1929	292, 947	473, 384	1932.	393, 480	658, 338

Exclusive of 215,000 vouchers paid and a like number of checks issued in connection with the campaign for control of the European corn borer.
 Exclusive of 89,000 vouchers paid and a like number of checks issued in connection with emergency drought relief and rehabilitation loans to farmers.

The disbursing clerk received from the various bureaus of the department and deposited in the Treasury to the credit of the proper appropriations or the required general fund revenue titles collections of public moneys totaling \$18,036,154.41. These collections consisted of \$16,179,634.72 in repayments to the proper appropriations of emergency-relief loans previously made to farmers in flood, storm, and drought-stricken areas, \$359,289.60 in repayments to other appropriations and funds, and \$1,497,530.09 in miscellaneous revenues accruing from sales of Government property, services rendered the public fees for the official inspection Government property, services rendered the public, fees for the official inspection, grading, or classification of commodities, interest on emergency-relief loans, and from other sources.

These collections involved the receipt, handling, verification, and posting of 9,781 schedules of collections (including 2,975 from the Washington regional seed loan office), comprising a very much greater number of individual remittances in the form of cheeks, drafts, money orders, and currency, transmitted to this office by the various bureaus of the department. In addition, 3,136 schedules of collections were received from the regional seed-loan offices at Memphis, Tenn., St. Louis, Mo., and Grand Forks, N. Dak., covering remittances deposited in the Federal reserve banks or branches at Memphis, St. Louis, and Minneapolis, to the credit of the disbursing clerk's account with the Treasurer of the United States. These also had to be verified received, and posted bringing the total States. These also had to be verified, receipted, and posted, bringing the total to 12,917. A total of 1,571 certificates of deposit were prepared and transmitted to the Treasurer of the United States and accounted for in the manner prescribed by the General Accounting Office.

OFFICE OF ACCOUNTS (OFFICE OF THE SECRETARY)

The office of accounts is responsible for the administrative audit and accounting for funds appropriated or otherwise contributed in connection with the broad activities of the Office of the Secretary, the Extension Service, the Office of Information, Grain Futures Administration, and the Office of Experiment Stations, the last named including the insular agricultural experiment stations and disbursing agents attached thereto. The work necessarily includes continuous



study of fiscal procedure, accounting methods, and recording and reporting forms, and involves studies and analyses of results with a view to advancing the adequacy of methods and accomplishment.

The routine activities of this office are shown in Tables 9, 10, and 11.

Table 9.—Audit work accomplished, 1931 and 1932

Fiscal year		Claims audited	Purchase orders presud- ited	Contracts audited	Hems involved
1931		15, 526	5, 869	266	168, 745
1932		15, 115	5, 277	226	1 167, 481

 $^{^{1}}$ Pream lit before release of 5,503 commutments my dve lact aggregate of \$6.6,791.94

Table 10.—Record of pay-roll and miscellaneous items, 1931 and 1932

	Fiscal year	- 4 -	Pay rells prepared	Pay-roll items	Letters of author- ization written	Collection claims filed	Transportation requests issued	Bills of lading issued
1931 1932			3, 138 3, 203	50, 379 51, 802	635 507	186 ~ 301	6, 237 5, 785	1, 918 1, 711

Table 11. - Funds under direct and indirect control of office of Secretary, 1931 and

	Fiscal year	Aggregate amount	Warrai ted to States	Offset by States	Supplementary State funds
1931 1932		\$33, 800, 259, 97 34, 278, 672, 98	\$13, 012, 936, 00 13, 255, 717, 00	\$6, 192, 936, 00 6, 774, 514, 02	\$8, 813, 102, 18 9, 000, 000, 00

The clearance of audited documents through the bookkeeping section involved

The clearance of anolted documents through the bookkeeping section involved more than 600,000 entries and the preparation of 732 regular period and a large number of special financial and statistical statements.

A new model double-head electric pay-roll machine installed in August, 1931, resulted in improved quality of work and increased the average production from 1,400 to 3,200 impressions per hour. During the six months ended June 30 this machine was used to address pay envelopes for the disbursing clerk, using a stock of leaft angalance which otherwise would have reverted to surplus stock. of kraft envelopes which otherwise would have reverted to surplus stock.

The making of the field pay rolls was continued by flat-bed bookkeeping machines and aggregated 2,811 rolls containing 28,049 items, the charges to individual salary records being made concurrently with preparation of the pay rolls. As an incident to the general operations of the office the file section received,

sorted, and filed alphabetically, numerically, or topically an average of more than 500 papers daily.

In addition to the regular work the office has collaborated with the General Accounting Office and State institutions in studies of accounting and expenditure classification and the construction of standardized methods and forms.

DIVISION OF PURCHASE, SALES, AND TRAFFIC

No fundamental changes in the organization structure of the division of purchase, sales, and traffic occurred, but further significant action was taken in the direction of progressive centred, but further signmeant action was taken in the direction of progressive centralization within the division of the supply activities of the department. Specific legislation in furtherance of the general plan has been secured, surveys of burean supply activities and stocks in the District of Columbia have been made, and arrangements for assignment to the division of approximately 25,000 square feet of space in the new Federal warehouse building of the Government at Eighth and D Streets SW., have been practically completed. An account of the operations of the division and a comparison with those of the previous year are given in Table 12.



Table 12.—Purcheses, sales, and other activities of the division of purchase, sales, and traffic, 1931 and 1932

	1931	1932
Bid section:		
Bid transactions mnnber mnnber	4, 456	4, 000
Flow of bids-	7, 300	1,000
First quarter per cent.	24	24
cound dust fet	17	15
	21	20
Fourth quarterdo. Bureau purchase in excess of \$500 approvednumber Aggregate amount	38	41
Aggregate amount dollars	150	129
Torcar toad Contracts examined brior to approval by Secretory purchase	1 200, 000 - 167	163, 742, 5
- VERIORALE ALLOHAL	6, 500, 900	3, 274, 854, 68
	100, 000	2 91, 000
A climite Qualitity Durchases of other surviling	22,358	21, 768 33
Table of Shi Phils held Droberty Transferred to other deportments de	3 4 158, 002, 87	34, 875, 44
THE OF SUI DHIS HELD OFOLDERLY PACELY OF FROM ALLOW CONSISTENCES	4.51, 341, 32	179, 018, 40
TOTAL OF A PARTIES OF COMMINISTRATION OF THE PROPERTY AND ASSOCIATION OF THE PARTIES OF THE PART		
another in department. dellars	1, 750, 53	3, 000
Initiar value of worn-out property transferred to General Supply Committee. dollars	13.5 0.17 0.15	
r ood samples destroyed	25, 597-33 786	20, 752, 41
Craftie section:	1 - (1)	1, 273
Freight routing furnished—		
Less than carload number	5 4, 710	4, 149
· Carroad	3 220	3 205
reaces thrillished—		
Freight munt er	5 6, 821	5 6, 140
1,517(0)5	5 150	5 263
thread most	5 1 285	\$ 1,083
Air	\$ 100 " 10	8 7.
Air do	10	³ 20
cheral supply section;		v 151
Stock issues during year	205, 017, 92	254, 261, 01
Purchase orders issued to maintain stocks	1	f 1.768
Furchase orders for other activities	6,578	5, 174
Money value involved, all purchase orders (5, 10 arc)	137, 018, 73	3, 102 00
Apperimental by-products sold:		
For deposit to miscellaneous receipts dellars	34, 0.16, 12	29, 192, 60
For cooperators	6, 795, 28%	2, 734-22

More than the amount given.
 Estimated.
 Contained release of 1927 corn-borer equipment.

4 11 months' record.
4 Approximate figure

Comparison of a recent inventory of stock on the shelves of the central supply section fixes its value at approximately \$67,000. In addition to its activities as a general supply unit, the section also maintains complete property records for all branches of the Offlice of the Secretary, and similar but separate records for the group reduction have of the secretary. for all branches of the Oflice of the Secretary, and similar but separate records for the crop production loan office and its seven field offices, all crop production loan office items of property being distinctly marked to distinguish them from department property. In developing its organization during the early months of 1932, the crop production loan office made no internal provision for a service of supply, but instead committed all functions of that character to the central supply section and has since relied on the section to effect its purchases and distribution of supplies. Although this imposed on the section, particularly at the outset, a great burden of additional work in the negotiation of prices, the placing of purchase orders, and the packing and shipping of huge quantities of supplies, uniformly efficient service has been rendered without additional cost other than that involved in the employment of three assistants in subordinate other than that involved in the employment of three assistants in subordinate

other than that involved in the employment of three assistants in subordinate temporary positions.

The chief of division was designated as this department's representative on the General Supply Committee. Otherwise assignments of division personnel to represent the department on various coordinating boards, as noted in the last annual report, have continued unchanged. While all the interdepartmental boards operating under the Chief Coordinator have been active, this has been particularly true of the Federal Purchasing Board. Its members have been called on to head committee groups to negotiate consolidated purchases of commonly used supplies and equipment and thus secure the benefits of the greater discounts applicable to larger quantities. Under this procedure, the Depart-



ment of Agriculture has already contracted for the needs of the Department of Commerce, the Department of Labor, and itself for mimeograph paper for field use during the first six months of the fiscal year 1933 and is at present engaged in the development of a contract for automotive equipment for the same department for the same veried. ments for the same period.

DIVISION OF OPERATION

New roofs were installed on the east and west wings of the main building, and four new passenger elevators and two new service elevators were installed in these same wings. The work involved in changing the electric current in the east and west wings from direct to alternating was not completed because of the delay in installing the necessary transformers. The bulk of the equipment was purchased and a considerable part of the actually necessary work performed, but the change can not be accomplished until the current source is provided.

Appropriations for the Office of the Secretary totaled \$1,449,102, and expenditures \$1.362.442.

Appropriations for the Office of the Secretary totaled \$1,449,102, and expenditures \$1,362,412.

Before the close of the fiscal year the newly completed portion of the Extensible Building was partly occupied by bureaus which had been quartered in rented buildings. This new structure, known as the South Building, contains 374,531 square feet of space, and represents the largest single building occupied by the department at this time. The completion of this building necessitated the consolidation of the cleaning forces of the various bureaus occupying space in the new structure. The importance of this centralized control of cleaning operations is appreciated when it is realized that \$1,285 square feet represent areas in corridors and lobbies, and 6,318 square feet in the various toilet rooms. corridors and lobbies, and 6.318 square feet in the various toilet rooms.

GENERAL ACTIVITIES

Approximately 8,000,000 pieces of mail were handled by the department post office during the year, of which approximately 500,000 cleared through the file room. No increases were made for permanent personnel in either group, but temporary assignments were necessary for both organizations.

The maintenance section was organized in anticipation of the development of the proposed consolidated cleaning organization and is responsible for the cleaning of both the South and Administration Buildings and the performance of the

mg of both the South and Administration Buildings and the performance of the necessary incidental labor work.

The addition of the South Building to the structures under the control of the department materially increased the responsibilities of the watch office.

The motor-transport service was formed during the year to handle the work involved in the operation of the motor-truck pool, the passenger-carrying vehicles, and the automobile repair shop. This work was formerly performed under the direction of the mechanical superintendent.

Representatives of the General Accounting Office made a survey of the cost-accounting methods conflowed in connection with the overrition of the mechanical superintendent.

accounting methods employed in connection with the operation of the mechaniaccounting methods employed in connection with the operation of the mechanical shops and the motor-transport service. As a result of these investigations a new cost-accounting system has been installed effective July 1, 1952. The cost-collection work was formerly performed in the office of the mechanical superintendent, but under the new procedure certain employees were detached and assigned to the newly organized cost-collection unit with headquarters at the mechanical-shops building, but actually under the direction of the chief accountant, Office of the Secretary.

Plans were developed for an enlarged and improved curer evelopes organization. But a South Building. Due to the necessity for strict communications.

Due to the necessity for strict economy m expenditures, considerable curtailment of the original proposal was necessary. Eme geney treatment was provided for a large number of employees, and the very great advantages resulting from the existence of such an organization were definitely demonstrated.

THE MECHANICAL SHOPS

The usual volume of maintenance work was performed by the shops, including the painting of the window frames of the east and west wings of the Administra-

on Building and the painting of the power plant.

Table 13 furnishes a comparison of the work performed by the mechanical shops (including motor-transport service) during 1931 and 1932.



Table 13.—Value of work performed by the mechanical shops, 1931 and 1932

Item	1931	1932	Decrease in 1932 over 1931
Gross expenditures Reimbursable work performed Shop requests	\$367, 363 227, 487 1 13, 861	\$352, 184 212, 199 1 12, 365	7

¹ Number.

TELEGRAMS AND TELEPHONE CALLS

The staff actually checked and audited 143,070 telegrams, which number in-

The staff actually checked and audited 143,070 telegrams, which number includes some field messages and those passing through the telegraph office maintained by the Bureau of Agricultural Economies, and prepared 228 combined vouchers for the telegrams with charges aggregating \$77,516.21.

On October 1, 1931, an auxiliary telephone switchboard was installed in Temporary Building F to serve the 139 main stations and 191 extension stations installed in Buildings C and F and in the National Museum. This installation resulted in the saving of several thousand dollars and provided improved and increased operating facilities for the personnel housed in these structures.

The number of telegraph messages handled and the number of telephones in service, and comparisons with other years are given in Table 14

service, and comparisons with other years, are given in Table 14.

Table 14.—Number of telephones in use and telegraph messages handled, 1928-1932

		Telegraph messages,		
Fiscal year	Main stations	Extension stations	Total	incoming and out- going
1928	665	712	1,377	36, 435
1929	700	762	1,462	49, 913
1930	721	789	1,510	50, 430
1931	918	905	1,712	61, 035
1932		941	1,859	62, 462

Based on traffic counts made at various times during the year, the following tabulation represents an estimate of the distributions of telephone calls made:

	Estimated number of calls made
Pranch to branch. Outgoing trunks. Outgoing Government trunks. Incoming trunks. Incoming Government trunks. Outgoing tie lines. Incoming tie lines.	57, 619 463, 386 105, 507 193, 402

REAL ESTATE AND HOUSING

The increased activity in connection with the Federal building program throughout the United States has produced an unusual volume of work in conthroughout the United States has produced an unusual volume of work in connection with the determination of space requirements on the part of the various bureaus and offices of the department. A number of these Federal buildings were completed during the year, and some increase in the space occupied in such buildings is shown in Table 15. Major increases in the amount of space so occupied and corresponding decreases of space in rented buildings can not, however, be expected in the immediate future.



Table 15.—Space occupied by Department of Agriculture and cost of rentals, 19

	Federal b	uildings		Rented	buildings	
Rureau or organiz ation	In Dis- trict of	Ontside District	in District of Columbia		Outside District of Columbia	
	Columbia	of Columbia 1	Area	Rental	Area	Rental
Agricultural credits	Sq. ft. 847	8q. ft.	Sq. ft.	Dollars	Sq. ft.	Dollars
Agricultural Economics Agricultural Engineering Animal Industry	11, 138 57, 073	61, 518 6, 765 66, 439	5, 923	1, 680	165, 347 15, 689 33, 488	140, 978 4, 920 39, 698
Biological Survey. Chemistry and Soils Dairy Industry. Entomology.	27, 299 70, 129 24, 606 50, 121	15, 288 2, 186 6, 617		16, 000	13, 473 12, 384 9, 700 134, 370	7, 710 3, 900 2, 478 58, 616
Experiment Stations. Extension Service. Farmers' seed loan.	17, 097 72, 496 3, 222	480 60, 752 7, 245			7, 116	5, 58 0 24, 01 0
Food and Drug Administration. Forest Service. Grain Futures Administration Home Economics	57, 523 3, 530 28, 879	60, 408 147, 473 778	74,971	37, 470	19, 338 399, 671 6, 788	131, 899 12, 931
Information. Library. Plant Industry.	53, 982 [‡] 75, 680 266, 879	11,894			37, 847	22, 260
Plant Quarantine and Control Admin- istration. Public Roads. Reconstruction Fluance Corporation	5, 111 24, 429 2, 440		27, 930 36, 909	() 15,000	268, 462 42, 186	66, 582 53, 323
Secretary. Weather Bureau.	177, 281 47, 775	1, 458 100, 689	5, 872 2, 224	(¹) 1,001	915 78, 564	882 118, 628
Total	1, 331, 041	[601, 727	217, 817	72, 051	1, 245, 338	694, 393

Exclusive of buildings owned by Department of Agriculture.
 Includes space temporarily assigned.
 Rental paid by another department.

In February, 1932, the Comptroller General of the United States rendered to the department a very important decision covering the leasing of quarters. In this decision it was held that although the contracting for such premises differed from the ordinary contract for supplies, services, etc., the department was not authorized to lease such quarters without first securing competitive bids. This requirement introduced a new element in the matter of handling lease procedure. Office of Personnel and Business Administration Circulars Nos. 196 and 201 were accordingly issued, setting forth in detail the methods to be pursued in arranging for both renewals and new leases:





REPORT OF THE DIRECTOR OF PERSONNEL AND 933 BUSINESS ADMINISTRATION, 1933 Agricultur

United States Department of Agriculture, OFFICE OF PERSONNEL AND BUSINESS ADMINISTRATION,

Washington, D.C., September 9, 1933.

Sir! I submit herewith the report of the work of the Office of Personnel and Business Administration for the fiscal year ended June 30, 1933.

Respectfully,

W. W. Stockberger, Director.

Hon. HENRY A. WALLACE, Secretary of Agriculture.

INTRODUCTION

The salient features of the work in the Office of Personnel and Business Administration during the liscal year 1933 will be found later in this report, under the respective divisions of the Office. Notwithstanding a sharp reduction in expenditures and in the personnel concerned with the regular activities of the Department,

three and in the personnel concerned with the regular activities of the Department, and the numerical reductions apparent in the statistical portions of the report, the establishment of new emergency agencies to try to check the farm decline has resulted in an actual increase in the work of this Office.

Despite successive shocks to the general morale occasioned by the reduction in salaries, the uncertainties regarding impending reorganizations and the fear of loss of employment, the employees of the Department have been assiduous in the discharge of their duties and eager to assist in any possible way in the program for the betterment of the situation in agriculture.

In this Office efforts made to render greater and more effective service, in the face of reduced funds for operation and with a diminished personnel, have been a heavy tax upon the energy and resourcefulness of the entire Office staff, but the purden has been borne with a cheerfulness and an esprit decorps worthy of par-

o irden has been borne with a cheerfulness and an esprit de corps worthy of particular mention here.

BRANCH OF PERSONNEL

DIVISION OF APPOINTMENTS

The Department personnel experienced a turnover of 3.88 percent during the fiscal year 1933, as compared with 5.98 percent during the fiscal year 1932, 7.95 percent during 1931, 9.79 percent during 1930, and 8.62 percent during 1929. Personnel data for the last 3 years are shown in table 1.

Table 1.—Personnel activities of the Department of Agriculture, 1931, 1932, and

	Employees on rolls of Department			Field	Employ-	Separa- tions	
Year ended June 30	Depart- mental service	Field service	Total	stations	ees appointed	from the Depart- ment	
1931	5, 639 5, 664 5, 521	22, 524 1 21, 764 2 21, 023	28, 163 27, 428 * 26, 544	1, 451 1, 451 1, 451	10, 258 6, 612 3, 915	7, 836 7, 425 4, 721	

¹ Includes 78 in foreign service. ² Includes 80 in foreign service.

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For the period July 1, 1932, to May 26, 1933, at which time the Crop Production Loan Office was transferred to the Farm Credit Administration, the following personnel actions were handled for that organization:

Annointments	,	2,870
Capamating	**************************************	2,602
Other actions		2.334

In compliance with the act of Congress (sec. 203, title 2, pt. 2, Public, No. 212, 72d Cong.), it has been necessary to obtain authority from the President to fill positions in the Federal Government, and for the fiscal year ended June 30, 1933, the Department of Agriculture has obtained 465 such authorizations.

During the fiscal year 1933, 144 formal applications for positions were received and circulated throughout the Department.

and circulated throughout the Department.

RECORD OF LEAVE

Statistics for leave during the ealendar year 1932 are not available because of legislation changing the procedure of granting annual leave. From January 1 to June 30, 1932, both annual and sick leave were allowed. However, the Economy Act of June 30, 1932, suspended annual-leave rights beginning with July 1, 1932, and continuing during the fiscal year 1933. This suspension was lifted, effective April 1, 1933, by the act of March 20, 1933. From July 1 to December 31, 1932, no annual leave was allowed, absence from duty during this period for reasons other than illness, was without pay and chargeable to the so-called legislative furlough. There was no change in the sick-leave regulations.

WORK INCIDENT TO APPOINTMENTS, TRANSFER, AND PROMOTION

Personnel changes in the Department during the fiscal year 1933 necessitated contacts with the Civil Service Commission, and certificates and authorizations were obtained as indicated in table 2.

Table 2.—Personnel changes in the Department of Agriculture, 1931, 1932, and 1938

	1931	1932	1933
Certificates from register Reinstatement certificates Certificates for change in status Transfer certificates Authorities for temporary appointments Authorities for extensions of temporary appointments Civil-service examinations requested	1, 420 385 619 289 762 432 11	702 212 194 165 462 443 6 26	74 27 108 69 94 66 67

RETIREMENT RECORDS

The Division of Appointments has continued work on the final completion of a new system of retirement records which was installed in the years 1931 and 1932, under which the Civil Service Form 2806 was substituted for the old master retirement card. During the past year it was generally used throughout the service with satisfactory results.

The passage of several far-reaching laws affecting retirement as well as other branches of Government work, notably the Economy Act of June 30, 1932, and the provision for 30-year retirement in the Independent Offices Act of June 16, 1933, has greatly increased the volume of retirement work, and its importance to the personnel of the Department.

Thirty-year retirement adds a new class of separations under the retirement laws and makes it possible for one involuntarily separated after 30 years of service, regardless of age, to receive an annuity less than the payment allowed for retirement at the age of 70 only by the deduction of 3½ percent of the actual gross annuity. This law applies only to those separated (in good standing) on account of reduction of force.

Figures showing retirements for the past 3 years are shown in table 3, and the

Figures showing retirements for the past 3 years are shown in table 3, and the average annuities paid in the various groups are shown in table 4.



Table 3.—Number of employees retired, 1931, 1932, and 1933

	Annuity retirements in class—				Disability retirements in class—					
Year ended June 30	Profes- sional	Subpro- fes- sional	Clerical, adminis- trative, and fiscal	Custo- dial	Profes- sional	Subpro- fes- sional	Clerical, adminis- trative, and fiscal	Custo- dial	Cases dis- posed of	
1931	36 22 81	\$8 41 132	20 13 22	27 9 25	7 . 8 . 9	17 17 23	20 8 19	3 10 15	307 378 329	

Table 4.—Averages of the annuities in the various groups, 1931, 1932, and 1933

Group	1931	1932	1933
Professional and scientifie	\$1,006.77 - 926.61 - 907.88 - 749.42 - ,	\$1, 100, 77 972, 67 981, 88 698, 57	\$1, 114. 04 1, 012. 91 903. 67 695. 98

Owing to that part of the Economy Act of June 30, 1932, which provides for Presidential approval for continuance in the Government service after retirement age, only four extensions were granted in the Department during the fiscal year 1933. A summary of the continuances for the past 3 years is shown in table 5.

Table 5.—Number of employees who received continuances after reaching retirement age, 1931, 1932, and 1933

Year ended June 30	Extensions						
rear ended June 30	First	Second	Third	Fourth		Sixth	
1931	53	29	3	1	2	1	
1933	ĩ	2	î	ő	ő	ŏ	

NEW ACTIVITIES

The establishment of the Agricultural Adjustment Administration in the Department of Agriculture, pursuant to act of Congress (title 1, Public, No. 10, 73d Cong., approved May 12, 1933), has greatly added to the responsibilities and duties of the Division of Appointments which has assisted in organizing and recruiting the necessary personnel for this new Administration.

OFFICE OF CLASSIFICATION

During the year the Division of Organization and Classification was abolished and the duties, together, with part of the personnel, were merged into the immediate office of the Director.

Subsequent to this change the Agricultural Adjustment Administration was organized, which will no doubt increase the classification work of this Office to the maximum of any previous year since its inception in 1924. A summary of this activity over the past 3 years is given in table 6.

Table 6.—Appointments and changes in status of employees of the Department of Agriculture, 1931, 1932, and 1933

Year ended June 30-	Appoint- ments to new po- sitions	Changes in duties	Changes to vacancies	Appeals	Total
1931	545	430	979	110	2, 064
1932	157	320	725	23	1, 255
1933	1 246	143	104	5	498

^{1 170} positions were allocated during June 1933 in the Agricultural Adjustment Administration.



BRANCH OF BUSINESS AND FISCAL OPERATIONS

THE DEPARTMENT BUDGET

Appropriations provided for the Department of Agriculture for all purposes during the fiscal year 1933 totaled \$318,885.991, as compared with \$301,554,375 for the fiscal year 1932. The items are given in table 7.

Table 7.—Department of Agriculture appropriations for fiscal years 1932 and 1933, as provided in the Department budget

Item	1932	1933
Regular appropriations, exclusive of road funds	\$91, 929, 375 187, 500, 000	\$77, 980, 991 108, 905, 000
Provided by Emergeucy Relief and Construction Act. Emergency relief loans.	22, 125, 000	132, 000, 000
Total	301, 554, 375	318, 885, 991

The distribution of these funds under group and bureau units is shown in table 8.

Table 8.—Department of Agriculture appropriations for fiscal years 1932 and 1933

	Fiseal	year
Activity	1932	1933
Ordinary activities: Office of the Secretary. Office of Information Library. Office of Experiment Stations (exclusive of payments to States) Extension Service (exclusive of payment to States) Weather Bureau Bureau of Animal Industry Bureau of Pairy Industry Bureau of Plant Industry Forest Service (exclusive of forest roads, payments to States, forest receipts and special funds, and forest-fire deficiency) Bureau of Chemistry and Soils Bureau of Entomology Bureau of Biological Survey Bureau of Public Roads (exclusive of Federal-aid highways) Bureau of Agricultural Engineering Bureau of Agricultural Economics Bureau of Plant Quarantine Orain Futures Administration Food and Drug Administration	\$1, 322, 115 1, 420, 961 110, 620 399, 410 1, 793, 560 4, 497, 720 16, 085, 195 796, 990 5, 839, 238 15, 184, 620 2, 104, 051 2, 863, 740 6, 229, 170 179, 940 656, 990 7, 241, 136 246, 700 3, 747, 930 221, 480 1, 810, 228 68, 751, 794	\$1, 206, 547 1, 335, 800 106, 100 294, 294 1, 888, 170 4, 164, 038 15, 324, 947 717, 448 4, 930, 874 10, 780, 924 1, 925, 080 2, 471, 700 1, 756, 177 618, 690 6, 649, 841 233, 365 2, 490, 125 218, 838 1, 716, 167
Payments to States (exclusive of road funds and national-forest receipt funds): State agricultural experiment stations for research under Hatch, Adams, and Purnell Acts (Office of Experiment Stations). State colleges of agriculture for extension work nuder Smith-Lever and supplemental acts (Extension Service). Forest-fire cooperation (Forest Service). Cooperative distribution of forest-planting stock (Forest Service). Total. Forest Service receipts and special funds: Refunds to depositors. National Forest Reservation Commission. Cooperative work. Payments to States and Territories (national-forest receipts fund). Payments to school funds, Arizona and New Mexico (national-forest receipts fund). Roads and trails for States (national-forest receipts fund).	4, 357, 000 8, 672, 936 1, 775, 000 95, 000 14, 899, 936 75, 000 500 1, 700, 000 1, 600, 000 40, 000 600, 000	4, 374, 000 8, 728, 096 1, 611, 580 79, 960 14, 793, 636 75, 000 475 1, 700, 000 1, 240, 000 40, 000 500, 000
Total	4, 015, 500	3, 555, 475



Table 8.—Department of Agriculture appropriations for fiscal years 1932 and 1933—Continued

	Fiscal	year
Activity	1932	1933
Special Items: Fighting forest fires (deficiency) Private claims and relief acts.	\$4, 260, 000 2, 145	\$1,000,000 2,755
Total	4, 262, 145	1, 002, 755
Total, exclusive of road funds and emergency relief loans	91, 929, 375	77, 980, 991
Road construction: Federal-aid highways: Agricultural Appropriation Act. Emergency Relief and Construction Act of 1932. Forest roads and trails: Agricultural Appropriation Act. Emergency Relief and Construction Act Public-land highways (Emergency Relief and Construction Act)	175, 000, 000	100, 000, 000 120, 000, 000 8, 905, 000 10, 000, 000 2, 000, 000
Total	187, 500, 000	240, 905, 000
Emergency relief loans: Loans to farmers in storm- and drought-stricken areas, Southeastern States-Agricultural credits and rehabilitation emergency relief loans. Collection of loans	20, 000, 000 125, 000	
Total	22, 125, 000	
Grand total	301, 554, 375	318, 885, 991

EMERGENCY APPROPRIATIONS UNDER THE AGRICULTURAL ADJUSTMENT ACT

The Agricultural Adjustment Act of May 12, 1933, provides a straight appropriation of \$100,000,000, available until expended, for carrying out the purposes of this aet, and authorizes the Secretary of the Treasury to advance such additional amounts as may be necessary for "administrative expenses, rental and benefit payments, and refunds of taxes", to be reimbursed from processing-tax receipts. *Under the latter authority the Secretary of the Treasury advanced up to June 30, 1933, the sum of \$500,000, making a total of \$100,500,000 available to the Agricultural Adjustment Administration for the fiscal year 1933. A comparatively small part of this amount, however, was expended during that fiscal year. The Agricultural Adjustment Act also appropriates the proceeds derived from all taxes imposed under the act for carrying out its purposes. In addition, the President is authorized to allocate not to exceed \$100,000,000 from the appropriations provided by the National Industrial Recovery Act for earrying out the Agricultural Adjustment Act and for the purposes of the Farm Credit Administration.

DIVISION OF ACCOUNTS AND DISBURSEMENTS

During the year the Division of Accounts and Disbursements disbursed \$233,-059,062.88 which required the examination and payment of 357,261 vouchers and pay rolls and the issuance of 627,562 cheeks on the Treasurer of the United States. As compared with the preceding fiscal year, this was a decrease of \$30,276,576.41 in the amounts disbursed, a decrease of 36,219 vouchers and pay rolls examined and paid, and a decrease of 30,776 cheeks issued.

The large decrease in disbursements was due in part to a curtailment in general

work activity and a reduction of approximately \$23,000,000 in payments to States for Federal-aid highway construction.

A comparison of the number of vouchers paid and cheeks drawn with the preceding 5 years is shown in table 9.



Table 9 .- Number of vouchers paid and checks drawn, fiscal years 1928 to 1933, inclusive

Fiscal year	Vouchers paid	Checks drawn	Fiscal year	Vouchers paid	Cheeks drawn
1928	1 267, 143	1 441, 025	1931	² 374, 349	648, 205
1929	292, 947	473, 384	1932	393, 480	058, 338
1930	333, 059	546, 145	1933	357, 261	627, 562

¹ Exclusive of 215,000 vouchers paid and a like number of checks issued in connection with the campaign for control of the European corn borer.

² Exclusive of 89,000 vouchers paid and a like number of checks issued in connection with emergency drought relief and rehabilitation loans to farmers.

The disbursing elerk received from the various bureaus of the Department and deposited in the Treasury to the credit of the proper appropriations or the required general fund revenue total collections of public moneys, exclusive of \$3,899,971.80 in special deposits, totaling \$3,501,937.48. These collections consisted of \$2,153,138.75 in repayments to the proper appropriations of emergency-relief loans made to farmers in flood, storm, and drought-stricken areas, \$382,-121.27 in repayments to other appropriations and funds, and \$966,677.46 in miscellaneous revenues accruing from sales of Government property, services rendered the public, fees for the official inspection, grading, or classification of commodities, interest on emergency-relief loans, and from other sources.

These collections involved the receipt, handling, verification, and posting of 7,861 schedules of collections (including 1,663 from the Washington Regional Seed Loan Office), comprising 53,488 individual remittances in the form of checks, drafts, money orders, and currency transmitted to this Office by the various bureaus of the Department. In addition 3,970 schedules of collections were received from the regional seed-loan offices at Memphis, Tenn., St. Louis, Mo., Dallas, Tex., Minneapolis, Minn., Salt Lake City, Utah, Spokane, Wash., and New Orleans, La., covering remittances deposited through the Federal Reserve banks or branches of these cities to the credit of the disbursing clerk's account with the Treasurer of the United States. These also had to be verified, receipted, and posted, bringing the total to 11,831. A total of 1,411 certificates of deposit were prepared and transmitted to the Treasurer of the United States and accounted for in the manner prescribed by the General Accounting Office.

OFFICE OF ACCOUNTS (OFFICE OF THE SECRETARY)

The Office of Accounts continued to function during the fiscal year 1933 in the same capacity as previously except that the volume and scope of work increased during the latter months due to extra duties added in connection with the Agricultural Adjustment Administration.

A summary of the routine activities of this Office are shown in tables 10, 11, and 12. -Audit work accomplished, 1931, 1932, and 1933

I ABLE 10. 21 aut.				
Fiscal year	Claims audited	Purchase orders preaudited	Contracts audited	Items involved
1931	15, 526 15, 115 14, 482	5, 869 5, 277 5, 227	266 226 182	168, 745 167, 481 1 120, 406

· 1 Preaudit before release of 5,409 commitments.

BLE 11.—Record of pay roll and miscellaneous items, 1931, 1932, and 1933

Fiscal year	Pay rolls prepared	Pay roll items	Letters of authoriza- tion written	Collection claims filed	Transportation requests issued	Bills of lading issued
1931	3, 138	50, 379	635	186	6, 237	1, 918-
1932	3, 203	51, 802	507	301	5, 785	1, 711
1933	3, 434	52, 592	2, 02 8	293	5, 862	1, 268-



Table 12 .- Funds under direct and indirect control of Office of Secretary, 1931, 1932, and 1933

Fiscal year	Aggregate amount	Warranted to States	Offset by States	Supplemen- tary State funds
1931	\$33, 800, 259, 97	\$13, 012, 936, 00	\$6, 192, 936, 00	\$8, 813, 102, 18
1932	34, 278, 672, 98	13, 255, 717, 00	6, 774, 514, 02	9, 000, 000, 00
1933	32, 092, 729, 41	13, 181, 927, 71	6, 547, 090, 28	7, 204, 760, 99

Audited documents passing through the bookkeeping section involved slightly less than 600,000 entries, but the preparation of regular period and special financial and statistical statements showed considerable increase. During the year a special tabulated statement or chart, long needed for reference purposes, was prepared showing all appropriations made to the Office of the Secretary, Office of Experiment Stations, Office of Information, and the Extension Service since the organization of the Department of Agriculture.

On July 1, 1932, the Office assumed the direction of, and responsibility for,

cost-accounting work at the Mechanical Shops, a section being organized to earry on the work, under an accounting system and procedure recommended by the General Accounting Office after a prolonged study in which this Office collaborated. Table 13 indicates in a general way the nature and volume of the documents and transactions handled by the Cost Collection Unit during the fiscal year 1933.

Table 13.—Partial record of Cost Collection Unit documents handled during fiscal year 1933

-	Time slips	Material issue slips		Rubber- stamp requests	Job cost sheets	Individ- ual bills rendered	Overhead applica- tion	Miscel- laneous
	60,000	24,000	10,000	5, 786	11, 536	16, 250	16, 250	26, 550

In addition to the routine work the Cost Collection Unit also prepared a large number of periodical and special statements showing the mouthly and progressive status of the work.

Following approval of the Agricultural Adjustment Act, this Office was designated to handle the accounting and auditing for the Administration's general

expenditures with particular reference to its cooperative field activities, and this has considerably more than trebled every phase of office work.

As an incident to the general operation of the Office the File Section received, sorted, and filed alphabetically, numerically, or topically an average of more than 500 papers daily, cleared transfer files for the period since July 1, 1915, of all correspondence having no further value as a record, received from the disbursing officers for the Alaska, Guam, and Virgin Islands Experiment Stations their complete financial records from the organization of the stations to June 30, 1932, and distributed them to the permanent files of the Department distributed them to the permanent files of the Department.

In addition to the regular work a large amount of accounting-survey and formconstruction work was earried on in connection with the General Accounting Office study of operating conditions at the Mechanical Shops, which resulted in a complete revision of methods and forms and the installation of a new cost-accounting system.

DIVISION OF PURCHASE, SALES, AND TRAFFIC

During the year further progress was made toward centralization, in the Division of Purchase, Sales, and Traffic, of the supply activities of the Department. Work of this type for one of the larger bureaus, Agricultural Economies, was taken over, and an entire floor, approximately 50,000 square feet, in the Federal warehouse was occupied. The execution of centralization plans was suspended, however, upon the President's announcement, near the end of the special session of Congress, that a single procurement agency for the Government as a whole was Congress, that a single procurement agency for the Government as a whole was to be set up in the immediate future.

An account of the operations of the division and a comparison with those of previous years are given in table 14.



Table 14.—Purchases, sales, and other activities of the Division of Purchase, Sales, and Traffic, 1931, 1932, and 1933

Item	1931	1932	1933	
Bid Section:	+			
Bid transactions	4, 456	4,000	3,000	
First quarter percent_ Second quarter do	24	24	- 28	
Third quarter do	17 21	15	17 20	
Fourth quarter do Bureau purchase in excess of \$500 approved number	38	41	35 70	
Aggregate amount: dollars	150 1 200, 000	129 163, 742, 53	53, 911. 66	
Forest-road contracts examined prior to approval by Sec-				
Aggregate amount dollars	6, 500, 000	3, 274, \$54, 68	145 10, 761, 152, 08	
Definite quantity purchases of auto tires and tubes do	100,000	294,000.00	66, 978, 19	
Definite quantity purchases of other suppliesdo Value of surplus field property transferred to other depart-	22, 358	21, 768. 33	20, 076, 66	
ments	3 4 158, 032, 87	34, 875, 45	4, 670, 00	
ments. dollars	151, 341. 32	179, 018. 40	83, 642, 00	
Value of District of Columbia property transferred from one hureau to another in Department dollars	4, 750. 33	3, 000, 00	8, 400. 00	
initial value of worn-out property transferred to General Supply Committee dollars	25, 597, 33	20, 782, 47	57, 713, 00	
Food samples destroyed number	786	1, 275	2,755	
Traffic Section: Freight routing furnished:				
Less than carload do	54,740	⁵ 4, 149	4,001	
Carload	⁵ 220	§ 205	383	
Freightdo	§ 6, 824	³ 6, 443	6, 982	
Expressdo	5 150	\$ 263	186	
Passengerdododo	⁵ 1, 285 ⁵ 100	51,085 575	987 80	
Air do.	5 10	⁵ 20	50	
Itineraries furnisheddo	598	§ 134	500	
Central Supply Section: Stock issues during yeardollars	205, 017, 92	254, 261. 01	¥54, 591. 52	
Purchase orders issued to maintain stocks number	6,578	1,569	7, 079	
Purchase orders for other activities do Money value involved, all purchase orders dollars.	437, 018, 73	593, 462, 00	565, 131, 44	
Experimental byproducts sold:		,		
For deposit to miscellaneous receipts	34, 026, 42 6, 795, 28	29, 292, 60 2, 734, 22	26, 555, 74 767, 56	

More than the amount given.

BID TRANSACTIONS

The decrease in the number of bid transactions from the preceding year (about 25 percent) was due principally to three causes: (1) During the year consolidated purchases of automotive equipment, of paper for field use, and of hydrogen gas for the Weather Bureau, and an extension of general contracts for gasoline in the field, materially reduced the number of solicitations and awards; (2) a like effect resulted from the Secretary's order permitting the Forest Service to conduct its own purchasing in connection with emergency-conservation work, since such purchases, in a measure at least, obviated the necessity for routine purchases ordinarily made through this Division; (3) the decreased volume of Bureau purchasing during the final quarter reflected the efforts of the Department to decrease its supplies in equal step with its curtailment of general activities.

AUTOMOTIVE EQUIPMENT

The estimates of the Department for the purchase of passenger-earrying vehicles during the fiscal year 1933 aggregated \$250,000, but of this total authorization approximately \$20,000 remained unused at the end of the fiscal year. The estimates for 1934 were cut by the Department to \$217,440. In the preparation of the latter estimates the needs of the several bureaus were not, as heretofore, covered in a single paragraph at the end of the bill but instead were separately indicated in the various bureau sections of the appropriation text. This new form of presentation of course had the approval of the Bureau of the Budget

² Estimated. ³ Contained release of 1927 corn-horer equipment.

⁴ II months' record.
⁵ Approximate figure.



and the chairman of the Congressional committees, the thought being that, because of the substantial amounts involved, bureau officials should supplement the usual general presentation with separate gyplanatory statements.

By assembling in two general procurements the bulk of the Department's need for automotive equipment, both passenger-carrying and truck, an estimated saving of at least \$70,000, over and above the discounts usually obtainable, was made.

SURPLUS PROPERTY

During the latter months of the year, the Division thoroughly canvassed the various bureaus for the purpose of segregating surplus furniture and office equipment in order that they might be reconditioned and in readiness for use by the Agricultural Adjustment Administration when legislation creating that activity became effective. By thus anticipating the needs of the new organization delays in getting under way due to equipment needs were minimized.

TRAFFIC ACTIVITIES

This section supervises and directs the traffic operations of the bureaus of the Department. It makes claim for loss or damage, traces for delayed or lost shipments, diverts shipments in transit, arranges for special ears or car service, and secures from the Federal Traffic Board for the bureaus and offices of the Department net freight rates necessary to making awards in the purchase of supplies, or in supplying other costs in shipping.

It keeps the shipping officers advised of changes in handling local shipping or

It keeps the shipping officers advised of changes in handling local shipping or local rates by rail, water, and truck, and furnishes such rates and shipping instructions.

SUPPLY WORK

During the year the Central Supply Section greatly improved its facilities for handling supply work. In July 1932 the Section moved from the basement and first floor of the Administration Building to more commodious quarters on the first floor and in the basement of the South Building. In October of the same year it also occupied the east half of the fourth floor of the Federal Warehouse, and when this additional space was found to be inadequate for this Department's needs the west half of the same floor was made available for storage and issue activity.

After occupancy of the space allotted in the Federal Warchouse the storage and issue work, including stocks, of the Bureaus of Agricultural Economies and Biological Survey was absorbed. Further consolidations have been held in abeyance pending developments in connection with the proposed consolidation of all Government supply activities in a procurement division of the Treasury Department.

It will be noted that the Section's purchases during the fiscal year 1933 are approximately the same as during 1932. This is accounted for by the large volume of purchase work necessary in connection with emergency organizations, notably the Crop Production Loan Office and the Agricultural Adjustment Administration.

SURPLUS EXPERIMENTAL MATERIALS

During the year the Division, operating through a department store, disposed of surplus materials resulting from experimental work at the nearby farms of the D partment, realizing net proceeds aggregating \$26,555.74 for deposit in the Treasury to the credit of miscellaneous receipts. During the same period and through the same channel it disposed of similar material developed in connection with cooperative work, in the amount of \$767.56, the proceeds being returned to the cooperators. All such material consisted chiefly of dairy and poultry products, meats, fruits, and vegetables.

COORDINATING BOARDS

During the year the chief of the Division continued to function as the Department's representative on the Federal Specifications Board, the Federal Purchasing Board, the General Supply Committee, and the Federal Standard Stock Catalog Board, while the traffic manager functioned as the Department's representative on the Federal Traffic Board, and one of the Division's staff served as a member of the Envelop Committee of the Post Office Department.



DIVISION OF OPERATION

Appropriations for the Office of the Secretary for the fiscal year 1933 totaled \$1,206,547 and expenditures \$1,001,945 as compared with \$1,449,102 and \$1,362,412, respectively, for the fiscal year 1932.

GENERAL ACTIVITIES

The two completed units of the South Building, the Administration Building, and the corridors and men's toilets of the east and west wings aggregate 556,971 square feet of space which is cleaned daily. Expenditures for salaries of the cleaning force aggregate \$93,615.46, with reimbursements in the amount of \$35,574.77. Expenditures for equipment amounted to \$4,721.78 and for supplies \$2,023.90. Waste-paper sales amounted to 539,920 pounds, and receipts from this source were \$517.01.

The volume of correspondence handled by the Secretary's file room has increased rapidly in recent months. The chief of this section cooperated with the Agricultural Adjustment Administration officials in the development and installation of a filing system for that organization, also the establishment of a mail collection and distribution system for the various units of the Administration. The cost of operating the guard force for the fiscal year 1933 was \$112,718.93, as compared with \$115,684.70 for 1932. The two completed units of the South Building, the Administration Building,

MECHANICAL SHOPS

The outstanding performance of the mechanical shops during the fiscal year was the construction of the exhibits for the Century of Progress Exposition at Chicago. This work was completed and shipped in time for erection prior to the opening of the exposition. The labor costs for the preparation aggregated \$16,298.89, the cost of materials involved an expenditure of \$4,159.66, a total of \$20,158.55.

\$20,458.55.

Table 15 furnishes a comparison of the work performed by the mechanical shops (including motor-transport service) during the fiscal years 1931, 1932,

Table 15 .- Value of work performed by the mechanical shops, 1931, 1932,

Item	1931	1932	1933	Increase or de- crease, 1933 over 1932
Gross expenditures Reimbursable work Shop requests (number)	Dollars 367, 363 227, 487 13, 861	Dollars 352, 184 212, 199 12, 365	Dollars 306, 841 181, 677 13, 500	Percent - 13 - 14 + 9

TELEGRAMS AND TELEPHONE CALLS

On August 20, 1932, the Department's telephone and telegraph section was moved from the west wing of the Administration Building to the fifth floor of the South Building, and on the same date the telephone switchboard was changed from the manual system to the automatic, or direct dialing system. Since this change eliminated the branch-to-branch and outgoing trunks and tic-line calls from the board, it enabled the Department to dispense with the services of three telephone operators. On April 19, 1933, the Arlington Experiment Farm telephone system was also changed from the manual to the automatic, with apparent increase in operating service for the 36 main and 7 extension stations located at this point.

The number of telegraph messages handled and the number of telephones in

service, in comparison with other years, are given in table 16.



Table 16.—Number of telephones in use and telegraph messages handled, 1929 to 1933, inclusive

		Telegraph messages,		
Year	Main stations	Extension stations	Total	incoming and out- going
1929 1930 1931 1932 1933	700 721 807 918 979	762 789 905 941 935	1, 462 1, 510 1, 712 1, 859 1, 917	49, 913 50, 430 61, 035 62, 462 60, 257

Based on traffic counts made at various times during the year, table 17 represents an estimate of the distributions of telephone calls made as compared with

Table 17.—Distribution of telephone calls made in the Department of Agriculture, 1933 and 1933

Type of call		Estimated number of calls made		
	1932	1933		
Branch-to-branch.		(1)		
Outgoing trunks	199, 979 57, 619	254, 245 62, 635		
Outgoing Government trunks	463, 386	2 552, S00		
Incoming Government trunk	105, 507	97, 804		
Outgoing tie lines	2.40.40.4	(1) 2 210, 200		
Outgoing long-distance and toll.		2 12, 127		
Incoming long-distance and toll		2 10, 250		

¹ Since the introduction of the automatic system no tally can be made of such calls.
² These calls handled by operators.

The staff actually checked and audited 150,532 telegrams, for which 248 combined vouchers were prepared, amounting to \$80,589.16. For the fiscal year 1932 there were 143,070 telegrams and 228 combined vouchers representing expenditures of \$77,516.21.

There were 200 telephone rental vouchers audited and passed to the various bureaus and offices for payment aggregating \$42,050.88, and 24 long-distance telephone-toll bills involving an expenditure of \$10,659.05.

REAL ESTATE AND HOUSING

The continued development of the Federal building program has resulted in the occupation of a number of completed structures, while tentative plans and approved drawings for a still larger number of buildings have been examined. This has resulted in an increase in the amount of the space occupied in Federal buildings though the program has not developed with sufficient rapidity to effect the amount of commercial space rented. It is particularly interesting to note that although the commercial area leased was increased by 137,083 square feet this rental was accomplished at a reduction of \$104,862. Such a decrease is in part attributable to the general lowering of rental rates, but it is believed that a material portion of this saving is due to the introduction of the requirement for competition in leasing. competition in leasing.

A tabulation by bureaus of building space occupied by the Department and cost of rentals for the year 1932 as compared with 1933, is not feasible (see report of Sept. 6, 1932, p. 11, table 15); however, the situation as it exists in 1933 is shown in table 18.



Table 18 .- Space occupied by Department of Agriculture and cost of rentals, 1933

	Federal buildings		Rented buildings			
Bureau or organization	In District of Co- lumbia	Outside District of Columbia	In District of Co- lumbla		Outside District of Columbia	
			Area	Rental	Area	Rental
Agricultural Adjustment Adminis- tration	Square feet 65, 982	Square feet 1	Square feet	Dollars	Square feet	Dollars
Agricultural Economics Agricultural Englneering Animal Industry Biological Survey	241, 859 12, 658 89, 436 28, 929	80, 169 7, 127 67, 730 18, 141			144, 607 30, 431 30, 636 25, 569	98, 338 6, 510 32, 966 9, 426
Chemistry and Soils	53, 528	5, 542 13, 188 480 111, 410	82, 895		9, 700 175, 393	3, 960 2, 479 58, 516
Farmers' Seed Loan 2. Food and Drug Administration Forest Service Grain Futures Administration	53. 873	61, 707 207, 646		37, 296	11, 386 560, 263	15, 283 146, 801
Home Economics Office of Information Library	29, 466 50, 048 48, 713	1, 217			5, 937	9, 364
Plant Industry Plant Quarantine Public Roads Secretary Weather Bureau	5, 111 23, 552 232, 656	10, 351 1 21, 777 44, 124 4, 090 118, 954	27, 930 36, 909 2, 224	(3) 15, 000	40, 054 221, 119 41, 883 1, 069 71, 055	17, 924 51, 972 44, 017 1, 062 90, 913
Total	1, 438, 278	773, 653	204, 929	69, 296	1, 382, 421	589, 531

Exclusive of buildings owned by Department of Agriculture.
 Transferred to Farm Credit Administration May 27, 1933.
 Rental paid by another department.

A summary of total space occupied by the Department of Agriculture and cost of rentals for the years 1931, 1932, and 1933 is shown in table 19.

Table 19.—Space occupied by Department of Agriculture and cost of rentals, 1931 to 1933, inclusive

Year	Federal buildings		Rented buildings			
	In District of Colum-	Outside District of Columbia	In District of Co- lumbia		Outside District of Columbia	
	bia		Area	Rental	Area	Rental
1931	Square feet 1, 027, 686 1, 331, 041- 1, 438, 278	Square feet 429, 140 601, 727 773, 653	Square feet 326, 629 217, 817 204, 929	Dollars 133, 945 72, 051 69, 296	Square feet 1, 317, 114 1, 245, 338 1, 382, 421	Dollars 745, 692 694, 393 589, 531

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REPORT OF THE DIRECTOR OF PERSONNEL AND BUSINESS ADMINISTRATION, 1934 | 34

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United States Department of Agriculture, Office of Personnel and Business Administration,
Washington, D. C., September 28, 1934.

Sir: I submit herewith the report of the work of the Office of Personnel and Business Administration for the fiscal year ended June 30, 1934.

Respectfully,

W. W. Stockberger, Director.

Hon. Henry A. Wallace,

Secretary of Agriculture.

INTRODUCTION

In preparing the accompanying report an effort was made to present as concisely as possible the major activities of the year. Much might be said of the constant, unselfish service of the employees who have had to meet almost imprecedented demands upon their energy and ability. The Office has cooperated with the Agricultural Adjustment Administration to the fullest extent in the work incident to building up the staff of that organization and in providing for its bounder.

The work of the Office is set forth under the individual divisions.

BRANCH OF PERSONNEL

DIVISION OF APPOINTMENTS

APPOINTMENTS, SEPARATIONS, AND PROMOTIONS

On June 30, 1934, there were 38,623 persons under appointment in the Department, as compared with 26,544 at the close of the fiscal year 1933, an increase of 12,079 employees. This large increase in the personnel of the Department is due to a gain of 5,020 employees in the Agricultural Adjustment Administration, which was organized May 12, 1933, and increases on account of the allotments of emergency appropriations from the Public Works Administration, the Civil Works Administration, and for the emergency conservation work. Personnel data for the last 4 years are shown in table 4.

Table 1.—Personnel activities of the Department of Agriculture, 1931, 1932, 1933, and 1934

	Employees	on rolls of 1	Pepartment			Separations	
Year ended June 30	Depart- mental service	Field service	Total	Field stations	Employees appointed	from the Depart- ment	
1931 1932 1933 1934	5, 639 5, 664 5, 521 10, 032	22, 524 ‡ 21, 764 ‡ 21, 023 ‡ 28, 591	28, 163 27, 428 26, 511 3 38, 623	1, 451 1, 451 1, 451 1, 451	10, 258 6, 612 3, 915 4 31, 434	7, 836 7, 425 4, 721 3 19, 355	

Includes 78 in foreign service.
 Includes 80 in foreign service.
 Includes 5,132 in Agricultural Adjustment Administration.
 Includes 11,667 in Agricultural Adjustment Administration.
 Includes 6,647 in Agricultural Adjustment Administration.

90909-34



In a lilition to the above number there were 969 collaborators serving without compensation on June 30, 1934. The largest number of employees previously in the Department was during the World War period, the total being 25,239 on

in the Department was during the world war period, the total being 20,200 m. July 1, 1918.

The Department personnel experienced a turnover of 10,63 percent during the fiscal year 1934 as compared with 3.88 percent during the fiscal year 1933, 5.98 percent during 1932, 7.95 percent during 1931, and 9.79 percent during 1930.

The number of appointments during the fiscal year 1934 was 700 percent more than the number appointed in 1933, while the number of separations was 310 percent more than in 1933. There were 914 changes of assignments involving promotions of employees to fill vacancies in higher grades in 1934 in comparison with 139 in 1933. The so-called "administrative promotions," i. e., promotions within the grade, were prohibited by the Economy Act of June 30, 1932.

Authorities were obtained from the President to fill 5,023 positions in the Department of Agriculture during the fiscal year.

During the year 254 formal applications for positions were received and circulated throughout the Department, as compared with 144 during the fiscal year 1933.

RECORD OF LEAVE

As indicated in the report for last year, statistics for leave during the calendar year 1932 were not available because of legislation changing the procedure of granting annual leave. However, statistics for sick leave for the calendar year granting annual leave. However, statistics for sick leave for the calendar year 1932 have been compiled. During this year employees were entitled to annual leave from January 1 to June 30. From July 1 to December 31, leave other than sick was charged to the legislative furlough without pay. It may be interesting to note whether or not the changing of the annual leave during this year had any effect upon the amount of sick leave taken. The records show that during the last 8 years men and women working for the Department in Washington took an average of 7.5 days sick leave. For the year 1932 the employees used 7.8 days of sick leave on the average.

In the field, where the limit of sick leave was 15 days, the 8-year average

In the field, where the limit of sick leave was 15 days, the 8-year average of sick leave taken by the men and women combined is only 3 days, while for 1932

the leave taken was the same as the 8-year average.

Contrary to the common report that Government employees in Washington take 30 days sick leave each year, it is found that during the last 8 years 27 percent of the employees of the Department did not take any sick leave while only 5.6 percent took the full amount of 30 days. In the field 52 percent of the employees took no sick leave, while only 6.7 percent took the maximum of 15 days.

WORK INCIDENT TO APPOINTMENTS, TRANSFERS, AND PROMOTIONS

Personnel changes in the Department necessitated contacts with the Civil Service Commission, and certificates and authorizations were obtained as indicated in table 2.

Table 2.—Personnel changes in the Department of Agriculture, 1931, 1932, 1933, and 1934

Item	1931	, 1932	1933	1934
Certificates from register. Reinstatement certificates Certificates for change in status Transfer certificates Authorities for temporary appointments Authorities for extensions of temporary appointments Authorities for extensions of suspensions. Civil Service examinations requested	1, 420 385 619 289 762 432 11 132	702 212 194 165 462 443 6 26	74 27 108 69 94 66 6 7	1, 510 481 254 465 4, 848 4, 031 3

RETIREMENT RECORDS

During the past fiscal year 259 employees were retired in accordance with the Retirement Act.

Figures showing retirements for the past 4 years are shown in table 3, and the average annuities paid in the various groups are shown in table 4.



	Annuity retirements in class				Disability retirements in class				
Year ended June 30	Profes- sional	Sub- profes- sional	Clerical, adminis- trative, and fiscal	Custo- dial	Professional	Sub- profes- sional	Clerical, adminis- trative, and fiscal	Custo- dial	Cases dis- posed of
1931 1932 1933 1934	36 22 81 51	88 41 132 63	20 13 22 58	27 9 28 24	7 8 9 12	17 17 23 12	20 \S 19 28	3 10 15 11	307 378 329 259

Table 4.—Averages of the annuities in the various groups, 1931, 1932, 1933, and 1934

Group	1931	1932	1933	1934
Professional and scientific	\$1,006,77	\$1, 100, 77	\$1, 114, 04	\$1, 102, 22
	926,61	972, 67	1, 012, 91	946, 81
	907,88	981, 88	963, 67	946, 83
	749,42	698, 57	695, 98	757, 72

Continuances in the service, which require the approval of the President, were practically eliminated by the Economy Act of June 30, 1932. Only two extensions beyond the retirement age were granted this consideration during the fiscal year, one for the Chief of the Bureau of Plant Industry for 6 months, and the other for the Chief, Division of Soil Survey, in the Bureau of Chemistry and Soils for Lyear. Soils for 1 year.

Table 5.—Number of employees who received continuances after reaching retirement age, 1931, 1932, 1933, and 1934

Year ended June 30	Extensions							
i ear ended June 30	First	Second	Third	Fourth	Fifth	Sixth		
1931 1932 1933 1934	53 60 1 2	$\begin{bmatrix} 29 \\ 35 \\ 2 \\ 0 \end{bmatrix}$	3 1 1 0	1 () () () ()	2 0 0 0	1 0 0		

The scope of the retirement work has greatly widened during the fiscal year and apparently will continue to do so. This is due partly to the new civil service retirement system which requires a monthly statement of the retirement deductions to the credit of the employees who are appointed and separated, and an annual report of the total amount of retirement deductions, deposits, and redeposits, by bureaus.

OFFICE OF CLASSIFICATION

By virtue of an act of Congress (Title 1, Public, No. 10, 73d Cong.; approved By virtue of an act of Congress (Title 1, Public, No. 10, 73d Cong.; approved May 12, 1933), the Agricultural Adjustment Administration was created. Under the terms of this act the Secretary of Agriculture was authorized to appoint such officers and employees, according to the terms of the Classification Act of 1923 and its amendments, and such experts as were necessary to execute the functions vested in him under the act.

As only 32 positions were termed expert, out of approximately 5,000, the creation of this Administration has greatly increased the classification work of the Department. It became necessary after several months of operation to place a departmental representative in the Agricultural Adjustment Administration with authority to investigate positions and prepare classification sheets for



presentation to the central office under the Director of Personnel. In this connection the Civil Service Commission rendered hearty cooperation.

During the fiscal year a number of reorganizations and readjustments of personnel within bureaus took place, and a vast number of positions in the field service were established, payable from emergency funds, which positions were allocated by this office in accordance with the terms of Executive Order No. 6440, dated November 18, 1933, and subsequent decisions of the Comptroller General.

A summary of this activity over the past 4 years is given in table 6.

Table 6.— Appointments and changes in status of employees of the Department of Agriculture, 1931, 1932, 1933, and 1934

Agriculture,	1001, 100			1	
Year ended June 30	Appoint- ments to new posi- tions	Changes iu duties	Changes to vacancies	Appeals	Total
1931	545 187 1 246 2 5, 561	430 320 143 * 1, 274	979 725 104 4 2, 329	110 23 5 15	2, 064 1, 255 498 9, 179

1 170 positions were allocated during June 1933 in the Agricultural Adjustment Administration.
2 4,751 positions were allocated in the Agricultural Adjustment Administration.
3 728 positions were allocated in the Agricultural Adjustment Administration.
4 1,964 changes were made in the Agricultural Adjustment Administration.

BRANCH OF BUSINESS AND FISCAL OPERATIONS

THE DEPARTMENT BUDGET

Funds made available to the Department of Agriculture for all purposes during the fiscal year 1934 totaled \$1,243,547,402. The items are summarized in table 7. The increase in funds, as compared with the fiscal year 1933, was due to emergency, relief, and other recovery measures, the regular funds of the Department having been reduced, as shown by tables 7, 8, and 9.

Table 7.—Department of Agriculture appropriations for fiscal years 1933 and 1934

Table 7.—Department of Agriculture appropriate	1933	1934
Regular appropriations: All objects except road eonstruction.	\$78, 095, 537 108, 905, 000	1 \$72, 216, 584 39, 457, 400
Total	187, 000, 537	111, 673, 984 437, 791, 725
Emergency appropriations and allotments: Road funds Agricultural Adjustment Administration Agricultural Englishments (exclusive of road funds)	132, 000, 000	647, 135, 000 25, 026, 363 885, 336
Agricultural Adjustment Administration. Public Works allotments (exclusive of road funds). Civil Works projects (supervisory allotments). Emergency conservation work.	132,000,000	21, 035, 000 1, 131, 873, 418
Total	319, 000, 537	1, 243, 547, 40
Grand total		

1 Expenditures limited to \$64,248,777.

An analysis of these funds is shown in tables 8 and 9.



Table 8.—Detailed statement of regular Department of Agriculture funds for fiscal years 1933 and 1934

		1934			
Activity	1933 appro- priation	Total appro- priation	Expenditure limitation		
Ordinary activities: Office of the Secretary	\$1, 206, 547 1, 335, 800	\$1, 181, 857 1, 226, 287	\$506, 639 999, 130		
LibraryOffice of Experiment Stations (exclusive of payments to	106, 100	. 100, 223	85, 976		
States) Extension Service (exclusive of payments to States)	294, 294 1, 688, 170	226, 961 1, 583, 822	203, 245 1, 215, 578		
Weather Bureau Bureau of Anlmal Industry	4, 161, 038 15, 321, 917	3, 731, 235 14, 398, 524	2, 961, 459 11, 906, 534		
Bureau of Dairy Industry Bureau of Plant Industry	717, 448 4, 268, 971	655, 130 3, 894, 222	550, 150 3, 291, 377		
Forest Service (exclusive of forest roads, payments to	1, 200, 011	13, 074, 222	.,		
States, forestry receipts and special funds, and forest-fire deficiency)	10, 780, 924	9, 952, 610	7, 792, 417		
Bureau of Chemistry and Soils	1, 925, 080 5, 623, 725	1, 766, 458 4, 984, 415	1, 500, 197 3, 747, 685		
Bureau of Biological Survey Bureau of Agricultural Engineering	1, 756, 177 618, 690	1, 356, 280 508, 206	1, 079, 918 424, 351		
Bureau of Agricultural Economics. Bureau of Home Economics.	6, 813, 350 233, 365	6, 232, 703 212, 749	4, 970, 529 173, 116		
Grain Futures Administration	218, 838	200, 000	176, 520		
Food and Drng Administration Total	$=\frac{1,716,167}{58,792,634}$	1, 589, 505	43, 398, 530		
	U(3) 1 (74), U(3)	00, 131, 101	17, 0.07, 0.0		
Special items: Fighting forest fires (deficiency)	1,000,000	1, 000, 600	¹ ² 412, 090 975, 000		
Quarantine) Grasshopper control (Bureau of Entomology and Plant		1, 000, 000			
Quirantin')			2, 314, 100		
Total	1, 000, 000	1, 000, 000	3, 701, 100		
Payments to States (exclusive of road funds and forest-receipt funds): State agricultural experiment stations for research under					
Hatch, Adams, and Purnell Acts (Office of Experiment Stations). State colleges of agriculture for extension work under Smith-Lever and supplemental Acts (Extension Serv-	4, 374, 000	1, 381, 000	1, 381, 00		
ice) Forest-fire cooperation (Forest Service) Cooperative distribution of forest-planting stock (Forest	8, 728, 096 1, 611, 580	8, 738, 096 1, 587, 513	8, 738, 09 1, 567, 68		
Service)	79, 960	74, 730	56, 130		
Total	14, 793, 636	11, 781, 339	14, 742, 90		
Forestry receipts and special funds (Forest Service):					
Refunds to depositors. National Forest Reservation Commission expenses	75, 000 576		60, 00 3, 50		
Payments to States and Territories (national-forest receipts fund) Penestr to school funds. Arizona and Nov. Marico (na	568, 257	650, 861	650, 86		
Payments to school funds, Arizona and New Mexico (national-forest receipts fund)	21, 221		28, 45		
Roads and trails for States (national-forest receipts fund) Cooperative work (contributed funds)	500, 000 2, 341, 213	370, 060 1, 516, 111	122, 28 I, 516, I4		
Total	3, 509, 267	2, 644, 058	2, 381, 23		
Total 4	78, 095, 537	72, 216, 584	64, 223, 77		
Road funds (regular):		00			
Federal-aid highways Forest roads and trails	100, 000, 000 8, 905, 000	35, 000, 000 4, 457, 400	35, 000, 00 4, 457, 40		
Total	108, 905, 000	39, 457, 400	39, 457, 40		
Grand total	187, 000, 537	111, 673, 984	103, 681, 17		

¹ In anticipation of the consolidation of the Bureaus of Entomology and Plant Quarantine, July 1, 1934, a rearrangement of funds prior to this date was effected which makes it impracticable to show separately the appropriations of these 2 Bureaus for 1934.

¹ Made available from unexpended halances of salaries and expenses, Forest Service, 1934.

³ Appropriated for expenditure in 1934 out of \$2,354,893 appropriation provided by Agricultural Appropriation Act, fiscal year 1935, and made immediately available.

⁴ Except road funds.

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Table 9.—Detailed statement of emergency funds available to Department of Agriculture for fiscal years 1933 and 1934

· Activity	1933	1934
Road construction: Federal-aid highways Forest roads and trails Public-land highways Special road grants to certain States Miscellaneous road projects	\$120,000,000 10,000,000 2,000,000	\$400, 000, 000 25, 100, 000 5, 000, 000 7, 431, 000 260, 725
Total	1 132, 000, 000	* 437, 791, 725
Advances from Treasury for tax refunds by Bureau of Internal Revenue. Allotment under section 220, National Industrial Recovery Act for corn-hog program (rental and henefit payments) and administration of codes.		3 100, 000, 000 4 490, 385, 000 4 19, 500, 000 5 37, 250, 000
Total		647, 135, 000
Public Works allotments (exclusive of road funds): Miscellaneons funds: Physical improvements and control of tree-destroying diseases and insects and injurious rodents in the national forests. Physical improvements at department field stations and in the District of Columbia Special projects (control of plant disease and insect pests, construction of crosion-control nurseries, purchase of land for National		14, 967, 745 4, 650, 582 5, 408, 036
Arboretum, and spray-residue investigations)		5 25, 026, 363
Total		° 25, 020, 363
Civil Works projects: Allotment to Department of Agriculture from Federal Civil Works Administration for supervision of work-relief projects relating to Department's activities Expenditures for work-relief projects, covering a miscellaneous group of activities affecting many phases of the work of the Department of Agriculture, including statistical and economic studies, pest- control work, physical improvements, etc		* 885, 330
Total		885, 330
Emergency Conservation work (authorized by Emergency Conservation Act of Mar. 31, 1933). Acquisition of additional forest lands (allotted for direct expenditure by Department of Agriculture). Purchase and rental of land for wildlife refuges. Investigations by Burcau of Chemistry and Soils to determine the selenium content of soils in certain areas. Civilian Conservation Corps activities on national-forest and other lands under supervisory direction of Forest Service, and certain special projects of other hureaus of Department carried out by C. C. C. cnrollees. Total.		7 20, 000, 000 8 I, 000, 000 9 35, 000 (10)
	122 000 000	1, 131, 873, 418
Grand total	132, 000, 000	1, 131, 573, 410

¹ Emergency Relief and Construction Act of 1932.
2 Public Works allotments under National Industrial Recovery Act.
3 Agricultural Adjustment Act.
4 Agricultural Adjustment Act.
5 National Industrial Recovery Act; unobligated halance to continue available in fiscal year 1935.
5 National Industrial Recovery Act; unobligated halance to continue available in fiscal year 1935.
6 Total of \$17,902,932 allotted from Public Works funds, made available by National Industrial Recovery Act; expenditures made through State Civil Works Administrations.
7 Of the \$20,000,000 made available under Executive Order No. 6208, dated July 21, 1933, \$18,965,000 was financed from National Industrial Recovery Act funds and \$1,035,000 from President's \$899,675,000 fund provided by the Emergency Appropriation Act, 1935.
6 Allocated to Department of Agriculture under Executive Order No. 6724, dated May 28, 1934; financed form National Industrial Recovery Act funds.
9 Allocated to Department under Executive Order No. 6235, dated Sept. 5, 1933; financed from National Industrial Recovery Act funds.
10 Financed from emergency funds through War Department, which continue available in fiscal year 1935.
11 The Budget schedules show allotments totaling \$38,651,845, including \$33,11,656 for work on national forest lands, \$37,316,939 on State and private lands, and \$223,200 for work on bird refuges and for special forest-inget and disease-control projects.
11 Unobligated balances to continue available in fiscal year 1935.



DIVISION OF ACCOUNTS AND DISBURSEMENTS

During the 11 months ended May 31, 1934, the Division of Accounts and Disbursements disbursed \$354,546,470.77, exclusive of rental-benefit payments under the provisions of the Agricultural Adjustment Act of May 12, 1933. This involved the examination and payment of 381,866 vouchers and pay rolls and the issuance of 1,016,597 checks on the Treasurer of the United States. Compared with the previous fiscal year, the amount disbursed during this 11-month period was \$121,487,407.89 greater than that for the full 12 months preceding, with an increase of 24,605 in the number of vouchers and pay rolls examined and paid, and an increase of 389,035 in the number of checks issued.

The rental-benefit payments under the Agricultural Adjustment Act, amount-

The rental-benefit payments under the Agricultural Adjustment Act, amounting to \$249,478,133.42 additional for the 11 months ended May 31, 1934, were made by a specially organized emergency section of the disbursing office, consisting of a large group of temporary personnel carried on the rolls of the Agricultural Adjustment Administration. These payments required the issue of 2,831,919 additional checks, which were prepared on punch-card forms by means of electric tabulating-machine equipment and automatically signed by electrically operated machines with the facsimile signature of the disbursing clerk, superimposed on a protective background of complicated design. This was the first time in the history of Government disbursing work that checks of this type were used and also the first time that the Treasury Department permitted the use of a facsimile signature on Government checks, without manual countersigning by a duly authorized deputy.

A comparison of the number of vouchers paid and checks drawn with the preceding 5 years is shown in table 10.

Table 10.—Number of vouchers paid and checks drawn, fiscal years 1929 to 1934, inclusive

Fiscal year	Vouchers paid	Checks drawn	Fiscal year	Vouchers paid	Checks drawn
1929	292, 947	473, 384	1932	393, 480	658, 338
1930	333, 059	546, 145	1933	357, 261	627, 562
1931	1 374, 349	1 648, 205	1934	381, 866	21, 016, 597

¹ Exclusive of 89,000 vouchers paid and a like number of ckecks issued in connection with emergency drought relief and rehabilitation loans to farmers.

² Exclusive of 2,831,919 checks issued for rental-benefit payments under the Agricultural Adjustment Act

of May 12, 1933.

The disbursing clerk received from the various bureaus of the Department and deposited in the Treasury to the credit of the proper appropriations and funds or the required general fund revenue accounts, collections of public moneys totaling \$6,402,036.75, exclusive of special deposits of Agricultural Adjustment Act cotton funds placed to his credit directly in the Treasury or Federal Reserve banks instead of being remitted through the disbursing office. The foregoing amount consisted of \$5,484,064.34 in repayments to the proper appropriations or funds and \$917,972.41 in miscellaneous revenues accrning from sales of Government property, services rendered the public, fees for the official inspection, grading, or classification of commodities and from other sources authorized by law. These collections involved the receipt, handling, verification, and posting of 5,366 schedules of collections, comprising 46,340 individual remittances in the form of checks, drafts, money orders, and currency transmitted to the disbursing clerk by the various bureaus of the Department.

The special deposits of Agricultural Adjustment Act cotton funds, mentioned

The special deposits of Agricultural Adjustment Act cotton funds, mentioned in the preceding paragraph as not being included in the disbursing clerk's regular collection account, amounted to \$140,022,419.54 additional and consisted of: (1) \$55,395,325.82 borrowed from banks and \$3,300,000 borrowed from the Reconstruction Finance Corporation to finance the cotton operations provided for by the act; (2) \$38,944,958.72 borrowed from the Commodity Credit Corporation for making advances to members of the Cotton Producers Pool at the rate of 4 cents per pound on cotton which had been optioned to them by the Government; (3) \$19,018,065 received from the Farm Credit Administration in adjustments on cotton acquired therefrom by the Department; and (4) \$23,364,070 in repayments made by the banks in connection with cotton transactions handled by them for the Secretary of Agriculture.



Under the terms of the Executive order of June 10, 1933, as amended, consolidating all disbursing activities of the Government in the Division of Disbursement, Treasury Department, the disbursing functions performed by the Division of Accounts and Disbursements of the Department of Agriculture were transferred to the Treasury Department on June 1, 1934, together with the personnel engaged in this work and the equipment used therefor. Effective on the same date the departmental accounting functions, previously performed by the Division of Accounts and Disbursements, were transferred to the newly created Office of Budget and Finance. Budget and Finance.

OFFICE OF ACCOUNTS (OFFICE OF THE SECRETARY)

The Office of Accounts is responsible for the administrative audit and accounting for funds appropriated or otherwise contributed in connection with the broad activities of the Office of the Secretary, the Extension Service, including a large volume of work in connection with the activities covered by allotments of funds from the Agricultural Adjustment Administration, the Office of Information, Grain Futures Administration, and the Office of Experiment Stations. The work necessarily includes continuous study of fiscal procedure, accounting methods, recording and reporting forms, and involves also analyses of results with a view to advancing the adequacy of methods and accomplishment. In addition the Office maintains detailed records of costs by States, activities, and commodities, segregates and reports travel expenses of Washington personnel by States and meetings attended, maintains a record of individual travel expenses classified as to meetings attended, maintains a record of individual travel expenses classified as to transportation and subsistence expenses and average costs per day of travel, and segregates and reports by classes and bureaus all printing and binding costs for use of administrative officers.

A summary of the routine activities of this Office is shown in tables 11, 12,

and 13.

Table 11.—Audit work accomplished, 1931, 1932, 1933, and 1934

Fiscal year	Claims audited	Purchase orders pre- audited	Contracts audited	Items involved
1931 1932 1933 1934	15, 526 15, 115 14, 482 52, 072	5, 869 5, 277 5, 227 8, 293	266 226 182 158	168, 745 167, 481 1 120, 406 533, 616

¹ Preaudit before release of 5,409 commitments.

The volume of work handled in the administrative audit section increased about 600 percent over 1933 and was greatly complicated by the requirement for segregating and coding all expenditures under agricultural adjustment programs counties, and commodities in addition to the usual objective elassification.

Table 12.—Record of pay roll and miscellaneous items, 1931, 1932, 1933, and 1934

	Fiscal year	Pay roll prepared	Pay-roll items	Letters of authoriza- tion writte:	Collection claims filed	Transportation requests issued	Bilis of lading issued
•	1931	3, 138 3, 203 3, 434 25, 124	50, 379 51, 802 52, 592 338, 963	635 507 2, 028 9, 959	186 301 293 270	6, 237 5, 785 5, 862 5, 565	1, 918 1, 711 1, 268 1, 935

On the basis of items alone the pay-roll work has increased more than 1,200 percent, but the required segregation of all Extension Service expenditures on agricultural adjustment programs by States, counties, and commodities, and incidental coding, more than trebled the purely statistical increase indicated.



DIRECTOR OF PERSONNEL AND BUSINESS ADMINISTRATION

Table 13.—Funds under direct and indirect control of Office of Secretary, 1931, 1932, 1933, and 1934

Fiscal year	Aggregate amount	Warranted to States	Offset by States	Supplementary State funds
1931	\$33, 800, 259, 97	\$13, 012, 936, 00	\$6, 192, 936, 00	\$8, 813, 102, 18
1932	34, 278, 672, 98	13, 255, 717, 00	6, 774, 514, 02	9, 000, 000, 00
1933	32, 092, 729, 41	13, 181, 927, 71	6, 547, 090, 28	7, 204, 760, 99
1984	41, 599, 128, 03	13, 119, 096, 00	6, 198, 096, 00	4, 321, 958, 40

The work in the administrative accounting section for the fiscal year 1934 showed a proportionately larger increase than indicated for other sections due to number and complexity of commodity budgets and necessary elaboration of records to meet the manifold needs of administrators and budget control. Operation on a cash-withdrawal basis together with requirements of the Economy Act relating to vacancies, legislative furlough, and executive salary reductions required the maintenance of special records and an unusual volume of entries under regular appropriations accounts. Activities under Agricultural Adjustment Administration cooperative field programs increased the bookkeeping work to more than 3,000,000 entries for the fiscal year, as against 600,000 in 1933. Financial reports rendered monthly increased from around 70 in 1933 to over 400 in 1934.

Effective July 1, 1933, all expenses in connection with the purchase, storing, and issue of supplies and/or equipment by the Central Supply Section were required to be charged proportionately as a part of the cost of the materials issued or service rendered, and the necessary overhead and collection accounts were organized and have been maintained in addition to the usual stock account.

Due to the transfer, during the year, of the mechanical shops to the Department of the Interior, the cost-accounting work being handled by this Office was discontinued.

DIVISION OF PURCHASE, SALES, AND TRAFFIC

Progress toward centralization of the supply activities of the Department in the Division of Purchase, Sales, and Traffie, which was suspended following the issue of Executive Order No. 6166 of June 10, 1933, establishing a Procurement Division in the Treasury Department with broad powers of general centralization, was resumed during the latter part of the fiscal year 1934, after the general regulations of the Procurement Division had appeared and the policies of that organization had been announced. One more of the larger bureaus of the Department—the Bureau of Plant Industry—was included in the departmental centralization before the close of the year.

ment—the Bureau of Plant Industry—was included in the departmental centralization before the close of the year.

Due to the operation of the many emergency agencies of exceptional size and scope created by the President and the Congress, as factors in the general recovery program, a sharp advance in the volume of business in every major activity of the Division occurred. An account of the operations of the Division and a comparison with those of previous years are given in table 14.

Table 14.—Purchases, sales, and other activities of the Division of Purchase, Sales, and Traffic, 1932, 1933, and 1934

		1	
Item •	1932	1933	1934
Bid Section:			
Bid transactionsnumber Flow of bids:	4,000	2, 831	4, 122
First quarterpercent	24	28	13
Second quarterdo	15	17	28
Third quarter do	20	20	21
Bureau purchase orders in excess of \$500 approved	41	.35	38
number	129	70	109
Aggregate amountdollars	163, 742, 53	53, 911, 66	346, 373. 57
Forest-road contracts examined prior to approval by			
Secretary number	65	145	165
Aggregate amountdollars	3, 274, 854, 68	10, 761, 152, 08	12, 164, 018, 13



Table 14.—Purchases, sales, and other activities of the Division of Purchase, Sales, and Traffic, 1932, 1933, and 1934—Continued

Item	1932	1933	1934
Definite quantity purchases of auto tires and tubes			
dollars	1 94, 000, 00	66, 978, 19	315, 726, 25
Definite quantity purchases of other suppliesdo	21, 768. 33	20, 076, 66	23, 186, 61
alue of surplus field property transferred to other de-	,	20,000	20, 20, 72
partmentsdollars.	34, 875, 45	4, 670, 00	(2)
alue of surplus field property received from other de-		,	
partmentsdollars	179, 018. 40	83, 642, 00	(2)
Value of District of Columbia property transferred from			**
one bureau to another in Department dollars.	3, 000, 00	8, 400, 00	4, 027, 13
nitial value of worn-out property transferred to Gen-			
eral Supply Committee dollars.	20, 782. 47	57, 713, 00	26, 860, 69
Food samples destroyednumber	1, 275	2, 755	1, 997
Freight routing furnished:			
Less than carload do do	3 4, 149	4 001	7 00 5
Carload do.	3 205	4, 001	7, 085
Rates furnished:	* 200	383	1, 337
Rates furnished: Freightdo	3 6, 443	6, 982	13, \$63
Expressdo	³ 263	186	19, 883
Passengerdo	3 1, 085	987	8, 163
Parcel postdo	3 75	80	11
Airdo	1 20	50	0
Itineraries furnisheddo	3 134	500	1, 043
Central Supply Section:			
Stock issues during year dollars	254, 261. 01	154, 591. 52	355, 283, 50
Purchase orders issued to maintains stocks_number	1, 569	7, 079	9, 098
Purchase orders for other activitiesdo	5, 174	, i	
Money value involved, all purchase orders dollars	593, 462. 00	565, 131. 44	1, 008, 110. 75
Experimental byproducts sold:	00 000 00	00.000.00	0.2 =0 0.0
For deposit to miscellaneous receiptsdo	29, 292, 60	26, 555. 74	28, 798, 86
For cooperatorsdo	2, 734. 22	767. 56	387. 29

 1 Estimated. 2 Since the Procurement Division took over this item, no record has been kept. 3 Approximate figure.

BID TRANSACTIONS

Heretofore the number of bid transactions has served as a reasonably accurate barometer of this important phase of the Division's business and the distribution of this volume throughout the year. Under the emergency purchasing conditions prevailing during 1934, however, this figure, for the year as a whole nearly 46 percent in excess of that for 1933, tells only a part of the story. So many of the individual procurement transactions involved the purchase of such large quantities of such large quantities of such large quantities of such large quantities. individual procurement transactions involved the purchase of such large quantities of equipment or material that the money amount involved in the average transaction handled by the Division in Washington advanced from \$882.34 in 1933 to \$2,980.83 in 1934. It is of significance, also, that the difficulties attendant upon efficient and expeditious purchasing were increased immoderately by the restrictions of the many N. R. A. codes on both bidders and procurement officers and by the eagerness of bidders for Government business in the absence of normal depends for equipment and material by the general public demands for equipment and material by the general public.

AUTOMOTIVE EQUIPMENT

Congress authorized the Department to expend for the purehase of passenger-earrying vehicles during the fiscal year 1934, \$217,440, but of this authorization more than \$20,000 remained unused at the end of the year. The authorizations earried in the Agricultural Act for 1935 have been further reduced to \$197,860 in the aggregate. Truck purehases during the fiscal year, for use principally by the Forest Service in connection with its emergency conservation work and other emergency projects, resulted in the acquisition of 10,000 or more units, the tire requirements alone of the Department, as shown in the tabular data, rising from approximately \$67,000 in 1933 to \$315,726.25 in 1934.

TRAFFIC ACTIVITIES

The summary of items of eurrent work performed by the Traffie Section (table 14) does not include the requisitioning and distributing of transportation requests and bills of lading, handling telephone ealls for information, making out travel requests, purehasing tickets, and other detail of current work. Loss and damage claims have been handled and numerous adjustments made on travel and freight charges.



DIRECTOR OF PERSONNEL AND BUSINESS ADMINISTRATION 11

Substantial savings have been made by this Section in travel accounts by advising and assisting the very large travel personnel of the Department, and by individually planning the order of many field trips to economize both time and travel costs.

Thousands of dollars have been saved in this way by use of excursion tickets with possible side trips that otherwise could not have been collected as suspensions on expense accounts by reason of lack of sequence in the specified dates and

places of travel as authorized.

Also, material savings have been effected in freight accounts by use of special emergency rates applying on large quantities of specific commodities moving for the Government, and cooperating with the Traffic Section, Procurement Divi-sion, in securing such rates, as, in the shipment of material necessary to meet grasshopper and chinchbug eradication.

SUPPLY WORK

The act making appropriations for the Department of Agriculture for the fiscal year ended June 30, 1934, provides:

The appropriations made hereunder shall be available for the payment of salaries of employees engaged in purchasing, storing, handling, Packing, or shipping of supplies and blank forms, and the amount of such salaries shall be charged proportionately as a part of the cost of supplies issued, and in the case of blank forms and supplies not purchased from this appropriation, the amount of such salaries shall be charged proportionately to the proper appropriation.

Under this authorization a surcharge plan was adopted to distribute the cost of operation as equitably as possible among the participating bureaus and offices. Separate surcharges, covering the three major phases of the supply work conducted by the Central Supply Section, were established, namely: Storage and issue, purchasing service, and form handling. During the year the rates shown in table 15 were set on the basis of volume of business and cost of operation.

Table 15.—Rates for surcharge, 1933-34

Period	Storage and issue	Purchasing service	Form-handling charge per month
July 1 to Dec. 31, 1933 Jan. 1 to Apr. 30, 1934 May 1 to June 18, 1934 June 19 to June 30, 1934	Percent 10 8 7	Percent 1 1 1 1 2 1 1 1 1 1 4	Dollars 300 300 300 300

It is of interest to note that these moderate charges adequately covered all operating expenses of the Central Supply Section, including salaries and wages, trucking expenses, telephone, and other miscellaneous expenses, including the purchase of material-handling and other equipment.

On account of the pressing need for warehouse and office space by the Procurement Division of the Treasury Department, which has headquarters in the Federal Warehouse, it was necessary to surrender to that organization approximately 18,000 square feet of floor space on the fourth floor of the Federal Warehouse where the major portion of the Section's supply work is carried on. This loss of storage space caused some congestion because the large volume of business demanded larger stocks and consequently greater storage space.

SURPLUS EXPERIMENTAL MATERIALS

During the year a change was made in the means employed in disposing of During the year a change was made in the means employed in disposing of surplus materials resulting from experimental work at the hearby farms of the Department. The Department Store, operating under the immediate supervision of the Division, went out of existence, its place being taken by a similar vending agency conducted by the Welfare Association of the Department. The surplus experimental materials are now sold through the new organization, prices being fixed as heretofore by the Division of Purchase, Sales, and Traffic, which also supervises the collection of the proceeds and their deposit in the Traceury to the credit of miscellaneous receipts. Treasury to the eredit of miscellaneous receipts.



COORDINATING BOARDS

With the establishment of the Procurement Division in the Treasury Department under Excentive Order No. 6166, the office of Chief Coordinator was abolished, together with many of the activities thereunder, other activities being continued in more or less modified form under the supervision of the Director of Procurement. Under the new arrangement, the Federal Traffic Board, upon which the traffic officer of the Department represented Agriculture, ceased to exist, the rate and routing work previously performed by the Board being provided for within the new procurement organization. The Federal Standard Stock Catalog Board and the Federal Specifications Board, however, are functioning practically as heretofore under the direction of the Director of Procurement; the chief of the Division of Purchase, Sales, and Traffic continues as this Department's representative on those Boards. Under the new set-up in the Procurement Division, there was created an advisory committee of five members, rotating among the several departments annually, to make studies of matters of policy affecting the various functions of the Procurement Division and to prepare the proper regulations and changes in regulations to make effecting the various determined upon in the Procurement Division. and to prepare the proper regulations and changes in regulations to make effective execution of the duties as determined upon in the Procurement Division, Braneli of Supply, including those of the various coordinating agencies under its control. During the fiscal year the Chief of the Division of Purchase, Sales and Traffic has served as a member of this committee. The Department of Agriculture was also represented on the envelop committee of the Post Office Department by an analysis of the Division of Purchase, Sales and Traffic ment by an employee of the Division of Purchase, Sales, and Trallic.

DIVISION OF OPERATION

The appropriations and expenditures for the Office of the Secretary during the past 3 fiscal years are shown in table 16.

Table 16.—Appropriations and expenses, 1932, 1933, and 1934

Item	1932	1933	1934
Appropriations	\$1, 449, 102	\$1, 206, 547	
Expenditures	1, 362, 412	1, 001, 945	

Includes \$17,296 provided in the First Deficiency Act, 1934, for rent of buildings in the District o

GENERAL ACTIVITIES

The establishment of the Agricultural Adjustment Administration and the transfer to the Department of the Interior responsibility for the administration of the buildings occupied by the Department of Agriculture in Washington, materially influenced the work of this Division. The creation of the Agricultural Adjustment Administration added to the volume of work so that it became necessary to employ additional personnel, while the transfer of functions of building a liministration to the Department of the Interior changed the character of administration from that of immediate supervision of the Guard Force, Maintenance Section, and Mechanical Shops, to that of coordinating the work as contact agency.

taet agency.

The treinendous demands for space necessary to house the constantly increasing personnel of the Agricultural Adjustment Administration necessitated the occupancy, early in the fiscal year, of the partially completed portions of wings 2 and 3 of the South Building and the utilization of the Library stack room between wings 4 and 5 of that building, as well as space in temporary structures. Organizations of the Department housed in the Administration Building and the South zations of the Department housed in the Administration Building and the South Building were moved to other quarters or required to very greatly reduce space occupancy. Major portions of the Office of Experiment Stations, the Bureau of Biological Survey, and certain units of the Bureau of Plant Industry and the Extension Service were transferred from the South Building to quarters in temporary buildings. These expedients proved unavailing and it was necessary to operate approximately 75 percent of the personnel of the Agricultural Adjustment Administration upon 2- and 3-shift working schedules. Arrangements were finally made near the close of the fiscal year for the assignment to the Agricultural Adjustment Administration of five floors of the old Post Office Building. This arrangement made it possible to transfer approximately 3.500 Building. This arrangement made it possible to transfer approximately 3,500



employees to this area with corresponding relief to the eongestion existing in the Administration and South Buildings, and the making possible of the transfer of the organizations housed in temporary buildings and other structures outside the general Department group. This eonsolidation of activities was materially aided by the completion of wings 6 and 7 of the South Building with the consequent practical doubling of the area available for utilization in that structure. The transfer of the remaining units of the Agricultural Adjustment Administration to space in wing 7 of the South Building and the rearrangement of the other Department organizations was in process at the close of the fiscal year.

The very great increase in the number of employees and the operation of a considerable portion of these on a 2- or 3-shift basis necessitated an increase in the nursing staff from 1 to 5 employees. With the transfer of a considerable group of Office Building it was necessary to establish a subsidiary emergency room in that structure and to assign 3 nurses for the care of the persounel. The number of patients treated has increased from a monthly average of approximately 500 to

patients treated has increased from a monthly average of approximately 500 to in exeess of 2,000.

SECTION OF MAIL AND FILES AND POST OFFICE

A count of letters and telegrams received in the file room during particular periods indicated an increase of 396 percent in the number of letters and 96 periods indicated an increase of 390 percent in the number of letters and 90 percent in the number of telegrams received as compared with similar periods during the previous fiscal year. A change was made in the operating procedure in connection with the handling of mail addressed to the Sceretary of Agriculture. Previously such correspondence has been opened in the immediate Office of the Sceretary and referred to the prepar hyrocur or efficial for the preparation of the Secretary and referred to the proper bureau or official for the preparation of the necessary reply. Under the new plan this work as well as the visaing of correspondence prepared for the Secretary's signature is performed in the file room. In addition responsibility has been assigned for the safeguarding and filing of all documents approved by the Secretary of Agriculture incident to the operation and enforcement of the Agricultural Adjustment Act.

A count of the mail received in the Department post office indicated an increase

A count of the mail received in the Department post office indicated an increase of 46 percent over a similar period during previous fiscal years. The working schedule for the operation of the mail trucks has been assigned so as to provide hourly service to and from the city post office. Plans have been developed for the operation of the pregnatic tube system serving the Administration Building the operation of the pneumatic-tube system serving the Administration Building and the South Building.

MOTOR-TRANSPORT SERVICE

The motor-truck pool comprises a fleet of 24 vehicles used for the performance of necessary general departmental work and available for use by the various bureaus and offices of the Department upon call. General departmental service is performed at the expense of the Office of the Secretary but bureau work is subject to reimbursement from the respective appropriations.

TELEGRAPH AND TELEPHONE SECTION

The great increase in the volume of telephone business occasioned an increase in personnel from 4 to 7. The number of telephones in use during the fiscal years 1929, 1930, 1931, 1932, 1933, and 1934, is indicated in table 17.

Table 17.—Number of telephones in use and telegraph messages handled, 1929 to 1934, inclusive

Year		Telegraph		
ı ear	Main stations	Extension stations	Total	messages, incoming and outgoing
1929 1930 1931 1932 1933 1933	700 721 807 918 979 1, 424	762 789 905 941 938 1, 258	1, 462 ,1, 510 1, 712 1, 859 1, 917 2, 682	49, 913 50, 430 61, 035 62, 462 60, 257 166, 158



Based on actual count and traffic tests made during the year table 18 represents an estimate of the number of telephone calls made, in comparison with other fiscal years.

Table 18.—Distribution of telephones calls made in the Department of Agriculture, 1932, 1933, and 1934

Two of call	Estimated number of calls made				
Type of call	1932	1933	1934 -		
Branch-to-branch. Outgoing trunks Outgoing Government trunks. Incoming trunks Incoming Government trunks. Outgoing ie lines. Incoming te lines. Outgoing long distance and toll. Incoming long distance and toll.	463, 386 105, 507 193, 402 149, 494	(1) 254, 245 62, 635 2 552, 300 97, 800 (1) 2 210, 200 2 12, 123 2 10, 250	(1) 374, 866 126, 181 2 811, 881 2 200, 490 (1) 2 311, 150 2 20, 700 2 18, 176		

¹ Since the introduction of the automatic system no tally can be made of such calls. ² These calls handled by operators.

There were audited 193,412 telegrains for which 253 combined vouchers were prepared amounting to \$117,112.60. For the previous fiscal year the number of telegrains was 150,532, with 248 combined vouchers representing expenditures

of \$80,589.16.

There were 305 telephone rental vouchers audited and passed to the various bureaus and offices for payment aggregating \$53,605.15, and 47 long-distance telephone toll bills involving an expenditure of \$50,084.65. This compares with a total cost for long-distance telephone tolls during the previous fiscal year of \$10,659.05.

REAL ESTATE AND HOUSING

The continued development of the Federal building program has made it possible for the Department to occupy space in a number of new Federal buildings throughout the country. Tentative plans and drawings for a considerable number of additional structures have been approved. In addition the Public Works Administration has approved projects involving the erection of several hundred buildings in various locations throughout the country. Despite the increase in the space occupied in Federal buildings there has been only a minor reduction in the amount of space leased, although there has been a marked reduction in the the amount of space leased, although there has been a marked reduction in the total rentals paid.

The outstanding changes in the housing situation in the District of Columbia were the completion and occupancy of portions of wings 1, 2, and 3 of the South Building, the completion and partial occupancy of wings 6 and 7 of the same building, and the assignment to the Department for the use of the Agricultural Adjustment Administration of five floors of the old Post Office Building. The additional space involved will make it possible for the Department to materially relieve the congestion existing in the South and Administration Buildings, to abandon all of the space occupied in Temporary Building C which is scheduled for demolition, to all andon the numerous small buildings in the neighborhood of Eighth and B Streets SW, which have been utilized, and, with the exception of portions of the to al andon the numerous small buildings in the neighborhood of Eighth and B Streets SW, which have been utilized, and, with the exception of portions of the Burcau of Animal Industry and the Extension Service, to move all units previously housed in Temporary Building F.—Unfortunately the amount of space available will not permit the making of any provision for the Forest Service, the Bureau of Public Roads, and the fertilizer investigation unit of the Bureau of Chemistry and Soils which are located in rented buildings.

Table 19 shows the space occupied by the various bureaus and offices of the Department at the close of the fiscal year and the total rentals paid.



DIRECTOR OF PERSONNEL AND BUSINESS ADMINISTRATION 15

Table 19.—Space occupied by Department of Agriculture and cost of rentals, 1934

	Federal	buildings	Rented buildings			
Bureau or organization	In District	n District Outside	In District of Columbia		Outside District of Columbia	
	Columbia	Columbia	Area	Rental	Area	Rental
Agricultural Adjustment Administra-	Sanare feet	Sanare test	Square feet	Dollars	Saugre feet	Dollars
tion			r square jett	370((1470	19, 972	21, 980
Agricultural Economics.	182, 147	118, 613			120 135	65, 331
Agricultural Engineering		7, 449	-		12,692	2, 016
Animal Industry		69, 582			28, 788	30, 625
Biological Survey		17, 064			26, 102	7, 757
Chemistry and soils	68, 224	3, 027	Ğ9, 744	14, 000	14, 547	3, 612
Dairy Industry	32, 160					96
Entomology	51, 397	13, 188				45, 349
Experiment Stations		450				
Extension Service	. 38, 920	114, 679				
Food and Drng Administration	39, 739	63, 049			5, 151	4, 810
Forest Service		164, 370	55, 629	46, 841	656, 772	156, 235
Grain Futures Administration					6,600	
Home Economies						
Office of Information						J
Library.						
Plant Industry		6, 677			49, 051	20, 42
Plant Quarantine		23, 953			117, 244	26, 81
Public Roads			28, 182	15, 600	72, 040 2, 630	50, 25
Secretary					2, 630	
Weather Bureau	36, 543	137, 710	2, 180	1, 0(8)	62, 507	76, 15
Total	1, 340, 879	794, 472	156, 033	76, 841	1, 343, 957	

⁴ Exclusive of buildings owned by Department of Agriculture.

A summary of total space occupied by the Department of Agriculture and cost of rentals for the years 1931, 1932, 1933, and 1934 is shown in table 20.

Table 20.—Space occupied by Department of Agriculture and cost of rentals, 1931 to 1934, inclusive

	Federal	buildings	Rented buildings				
Year	In District	Outside District of	In Distr Colum		Outside D Colum		
	Columbia	Columbia	Area	Reutal	Area	Rental	
1931 • 1932 1933 1934	Square feet 1, 027, 686 1, 331, 041 1, 438, 278 1, 596, 798	Square feet 429, 140 601, 727 773, 653 794, 472	Square feet 326, 629 217, 817 204, 929 192, 779		1, 245, 338		

U.S. GOVERNMENT PRINTING OFFICE: 1934



REPORT OF THE DIRECTOR OF PERSONNEL, 1935

UNITED STATES DEPARTMENT OF AGRICULTURE, OFFICE OF DIRECTOR OF PERSONNEL, Washington, D. C., September 18, 1935.

Hen. HENRY A. WALLACE, Secretary of Agriculture.

DEAR MR. SECRETARY: Herewith I submit a report of the work in Office of Personnel for the fiscal year ended June 30, 1935. Sincerely yours,

W. W. STOCKBERGER, Director.

INTRODUCTION

The large additions to the personnel of the Department resulting from emer-The large additions to the personner of the Department resulting from emerging activities, and the consequent increase in the volume and complexity of activities, and budgetary transactions led to the establishment, at the close of the ancial and budgetary transactions led to the establishment, at the close of the fiscal year 1934, of two coordinate agencies, the Office of Personnel and the fiscal year and Finance, in lieu of the former Office of Personnel and Busi-Office of Budget and Finance, in lieu of the brought the organization of the personnel and the second seco ness Administration. This action, which brought the organization of the per-new work of the Department into line with modern views on personnel man-pendent, has made it possible to give more consideration to the development of merale and the improvement of human relations within the service.

TRAINING IN PERSONNEL MANAGEMENT

Responsive to numerous requests from employees for training in personnel work, an experimental course of 10 lectures on the Elements of Personnel Administration, was offered as a part of the educational program of the Graduate School of the Department. The lecturers included outstanding representatives of the field of industrial personnel as well as Government officials. Registrants of the course which was open to all Government employees in Washington and the development of a new organization or the rapid expansion of an existing of effective operation is often retarded by inability to secure adequately trained

In the development is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation is often retarded by inability to secure adequately trained one, effective operation of the effective operation operation of the effective operation of the personnel. The effectiveness with which an organization can absorb the shock of adden, large expansion in personnel depends upon the extent to which the men we are second or third in line have received training in the basic principles of aministration in the positions next above their own in responsibility. It is therefore recommended that training in administration and in personnel management be made a part of the permanent program of the Department.

POST-ENTRY TRAINING

A short period of intensive "training on the job" would yield large dividends A short period of intensive training on the job would yield large dividends especially from employees whose work, to be effective, must produce comparable results, such as estimators, inspectors, cotton classers, and grain graders. In some of our bureaus, notably in the Forest Service and in the Bureau of Agriculural Economics, training programs have been in effect for several years, and the increased effectiveness of the work performed by employees who completed the courses points the way to effect further improvement in the service.

At present we have no recognized procedure for fully acquainting new appointees in the lower grades with the duties they may be called upon to perform. pointees in the lower grades with the duties they may be caned upon to perform. Stenographers, for example, may be assigned to a supervisor who will see that they receive instruction in the objectives of the work, in the organization of the bureau in which they are assigned, and in the minutia of office procedure, or they may be placed at a desk and left to acquire the necessary information as best they can. Provision should be made for an orientation course for such new



Two hours a week for a period of from 4 to 6 weeks devoted to appointees. Two hours a week for a period of the provided for effective service servic Opportunity for advanced training should be provided for older employees some of whom, after years of service, find themselves in blind-alley jobs, or discover that they are not fitted for the work to which they are assigned. For such employees our system of assignment should be expanded and made more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees with the job for which they are better the provide more employees. such employees our system of assignment should be explanate that they are beginned they are beginned and which carries with it an opportunity for advancement. Such a problem of the beginning of fitted and which earries with it an opportunity for all the so-called "personnel" problem edure, it is believed, will materially decrease the so-called "personnel" problem. in many of the bureaus.

APPOINTMENTS, SEPARATIONS, AND PROMOTIONS

On June 30, 1935, there were 44,080 persons under appointment in the Department, as compared with 38,623 at the close of the fiscal year 1934, an increased 5,457 employees. The Agricultural Adjustment Administration increased at force from 5,152 to 6,136 during the fiscal year, a net gain of 984 employees. The emergency appropriations from the Public Works Administration and for the emergency conservation work were continued through the year. On March 25, 1935, the Soil Conservation Service with its 1,272 employees was transferred from the Department of the Interior to this Department, and by June 30, 1935 the number of employees in that Service had increased to 1,853. On June 1, 1935, 1,670 employees of the Agricultural Adjustment Administration were transferred to the Resettlement Administration. Personnel data for the last 5 years are shown in table 1. years are shown in table 1.

Table 1.—Personnel activities of the Department of Agriculture, 1931, 1932, 1933, 1934, and 1935

	Employees on rolls of Department					
Year ended June 30—	Depart- mental service	Field service	Total	Field stations	Employees appointed	Separation from the Depart.
1931 1932 1933 1934 1935	5, 639 5, 664 5, 521 10, 032 11, 437	22, 524 1 21, 764 2 21, 023 2 28, 591 4 32, 643	28, 163 27, 428 26, 544 38, 623 44, 080	1, 451 1, 451 1, 451 1, 451 1, 864	10, 258 6, 612 3, 915 3 31, 434 4 29, 092	7, 58 7, 12 4,71, 1 19, 12 1 23, 635

Includes 78 in Foreign Service.
 Includes 80 in Foreign Service.
 Includes 11,667 in Agricultural Adjustment Administration.
 Includes 6,647 in Agricultural Adjustment Administration.
 Includes 52 in Foreign Service.
 Includes 8,240 in Agricultural Adjustment Administration.
 Includes 7,456 in Agricultural Adjustment Administration.

On June 30, 1935, there were 1,072 collaborators serving without compensation, who are not included in the above figures. The largest number of employees in the Department during the World War period was 25,239 on July 1, 1918. The

the Department during the World War period was 25,239 on July 1, 1918. The present force of 44,080 shows a gain over that period of 18,841 employees, or 75 percent.

The turn-over of permanent employees during the year was 7.19 percent, as compared with 10.63 percent during the fiscal year 1934; 3.88 percent during 1933; 5.98 percent during 1932; and 7.95 percent during 1931. The apparent decrease in the turn-over during the year as compared with 1934 is accounted for by the fact that during the fiscal year 1934 employees appointed regularly from civil-service certificates for a probationary period for the duration of the work were counted as permanent in 1934, whereas during 1935 they were counted as temporary or emergency employees.

as temporary or emergency employees.

The number of persons appointed during the year was 29,092, and the number separated 23,635, as compared with 31,434 appointments and 19,355 separations during 1934. In both of these years, owing to the establishment of the Agricultural Adjustment Administration and other emergency offices, there was an abnormally large number of appointments and separations as compared with

previous years.



The number of persons promoted during the year was 3,764, as compared to 144 promoted during 1934. Of this number, 1,470 were in the Agricultural adjustment Administration. The so-called "administrative promotions", i. e., adjustment within the grade, were still prohibited during the year by the Economy act of June 30, 1932. These promotions are accounted for principally by changes a seignments incident to filling vacancies in the higher grades. Index a requirement of the Economy Act authority was obtained from the president to fill 6,024 positions in the Department of Agriculture during the year. During the year 410 formal applications for civil-service positions were received and circulated throughout the Department, as compared with 254 during 1934.

RECORD OF LEAVE

puring the ealendar year 1933, the legislative furlough was in effect until March 31, 1933. Beginning April 1, annual leave was restored at the rate of 15 days per annum. As annual leave was not allowed for the full year, no statistics were compiled. However, statistics for sick leave for the calendar year 1933 are been compiled. As indicated in last year's report the decrease of the amount of annual leave to 15 days did not materially affect the amount of sick leave taken by the employees of the Department. In fact, during the calendar year 1933 the amount of sick leave taken by employees in Washington was slightly set than the 8-year average, the average for 1933 being 7.3 days, whereas the least than the 8-year average, the average for 1933 being 7.3 days, whereas the crear average was 7.5 days.

in the field where the limit of sick leave was 15 days, the average sick leave taken during the year 1933 was also less than the 8-year average, being 2.7 days for 1933, while the 8-year average ended with December 31, 1933, was 3 days.

Though it is commonly reported that Government employees in Washington take 30 days sick leave each year, the records show that during the calendar year 1933 only 4.9 percent of the employees in Washington took the maximum amount, while 27 percent of the employees did not take any siek leave. In the field for the calendar year 1933 only 4.5 percent took the maximum amount, and 50 percent took none. The 8-year average of employees taking the full amount of sick leave is 5.5 percent for Washington and 6.4 percent for the field, and 27 percent of the employees in Washington and 52 percent of the field force used no sick leave. used no siek leave.

WORK INCIDENT TO APPOINTMENTS, TRANSFERS, AND PROMOTIONS

Personnel changes in the Department necessitated contacts with the Civil Service Commission, and certificates and authorizations were obtained as indicated in table 2.

Table 2.—Personnel changes in the Department of Agriculture, 1931, 1932, 1933, 1934, and 1935

Item	1931	1932	1933	1934	1935
Certificates from register	1, 420 385	702 212	74 27	1, 510 481	1, 648 416
Cartificates for change in Status	619	194	108	254	910
Authorities for temporary appointments Authorities for extensions of temporary appoint-	289 762	165 462	69 94	465 4, 848	220 740
mants.	432	443	66	4, 031	1, 466
Authorities for extensions of suspensions	132	- 26	7	29	110

RETIREMENT RECORDS

During the past year 205 employees were retired in accordance with the

Figures showing retirements for the past 5 years are shown in table 3, and the average annuities paid in the various groups are shown in table 4.



Table 3.—Number of employees retired, 1931, 1932, 1933, 1934, and 1935

	Annulty retirements in class				Disability retirements in class				
Year ended June 30-	Profes- sional	Sub- profes- sional	Clerical, adminis- trative, and fiscal	Custo- dial	Profes- sional	Sub- profes- sional	Clerical, adminis- trative, and fiscal	Custo.	of Cases
1931 1932 1933 1934 1935 1 Corrected figure.	36 22 81 51 46	88 41 132 63 65	20 13 22 58 24	27 9 28 24 12	7 8 9 12 10	17 17 23 12 14	20 8 19 28 29	3 10 15 11 5	- 13 - 15 - 15 - 15 - 15 - 15 - 15 - 15

Table 4.—Averages of the annuities in the various groups, 1931, 1932, 1933, 1935

Group	1931	1932	1933	1934	1935
Professional and scientific	\$1,006.77 926.61 907.88 749.42	\$1, 100. 77 972. 67 981. 88 698. 57	\$1, 114, 04 1, 012, 91 963, 67 695, 98	\$1, 102.22 946.81 946.83 757.72	\$1,000 11 900.00 825.75 728.50

Since the requirement in section 204 of the Economy Act that exemptions from compulsory retirement must be approved by the President, extensions in the service upon reaching the age for retirement were limited to one associate economic geologist in the Bureau of Public Roads, who received a continuance in the service for 1 year. A senior pathologist in the Bureau of Plant Industry, granted continuances in the service in previous years, were granted further extensions for 1 year during the fiscal year.

In addition to the above, the retirement section forwarded to the Civil

extensions for 1 year during the fiscal year.

In addition to the above, the retirement section forwarded to the Civil Service Commission 1,188 applications for refund of retirement deductions, & Service Commission Master Retirement Record Card No. 2806 for employees who resigned, transferred to other establishments, or separated for other reasons. There were 183 employees who obtained credit for past temporary or excepted service as provided for under section 9 of the act of May 29, 1930, and redeposited the amounts previously refunded.

the amounts previously refunded.

There should be established as soon as practicable a follow-up system on probationers. Under the procedure now in effect a person appointed in the professional service from a civil-service certificate serves a probationary period of 1 year. In the clerical, administrative and fiscal, the subprofessional, and the custodial services the period of probation is 6 months. The existing requirement is a report from the chief of the bureau 1 month before the expiration of the probationary period, certifying to the probationer's service during the period of 11 or 5 months, respectively. If the report is satisfactory, he is retained; but if unsatisfactory, he must be transferred to another assignment or separated to scrutinize and report upon the probationer's efficiency and fitness for the service, the single and too frequently perfunctory report would be replaced by a definite determination of ability to do the work required.

INVESTIGATIONS

An unpleasant but necessary part of personnel administration is the investigation of cases involving irregularities or misconduct on the part of employees. This task is assigned to a chief investigator who with assistants conducts investigator. gations both in Washington and the field, and upon request of the bureaus also investigates cases of alleged violations of the various regulatory laws which are administered by the Department; makes periodical inspections of field offices;



reviews and analyzes reports containing recommendations for disciplinary action submitted by the various bureaus; prepares for the consideration or signature of the Secretary, briefs of such cases, letters of charges, decisions, reprimands, and correspondence relative thereto, and reviews such correspondence when prepared in the bureaus. reviews and analyzes reports containing recommendations for disciplinary action

CLASSIFICATION OF POSITIONS

During the fiscal year the work of classification, required by the Classification Act of 1923, as amended, nearly equaled in volume that of the previous year. The continuation of emergency allotments, the transfer of the Soil Conservation Service from the Department of the Interior, and the reorganization of certain the work in the various bureaus have occasioned a large part of the classification. Service from the Department of the Interior, and the reorganization of certain lines of work in the various bureaus have occasioned a large part of the classification work required.

A summary of this activity, insofar as it relates to the personnel in Washington, for the past 5 years is given in table 5.

Tible 5.—Appointments and changes in status of employees of the Department of Agriculture, 1931, 1932, 1933, 1934, and 1935

Year ended June 30—	Appointments to new positions	Changes in duties	Changes to vacancies	Appeals	Total
16 +	545	430	979	110	2, 064
	187	320	725	23	1, 255
	246	143	104	5	498
	5, 561	1, 274	2, 329	15	9, 179
	1, 634	3, 315	3, 260	45	8, 254

In addition to the above, and in anticipation of the time when classification may be extended to the field service, tentative classifications of all permanent, new processions created in the field were reviewed and aligned with departmental standards of the processions of complexes who are the processions are the processions of complexes who are the processions are the processions of the time when classification may be extended to the field service, and in anticipation of the time when classification may be extended to the field service, tentative classifications of all permanent, new processions are the procession of the time when classification may be extended to the field service, tentative classifications of all permanent, new processions are the procession of the procession o ards; also thousands of positions of employees who were paid from emergency fands were classified in accordance with the requirements of Executive Order No.

Charts showing the organization of the various bureaus and offices in the requirement were prepared at the request of the Emergency Council, at which the standardization was effected in the terminology of the administrative subsystems within the bureaus, and a revision begun of obsolete descriptions of wrk, which is still in progress.

EMPLOYEE ACTIVITIES

The Office of Personnel has sponsored the establishment of various welfare and reational activities, and has encouraged the voluntary formation of groups of apployees with a view to working out ecoperative plans for their mutual advantage and satisfaction. Some outstanding examples of these activities are:

The Welfare Association, a self-sustaining organization which makes non-interest-

bearing loans to employees in need, operates a eafeteria and a store, employs a full-time welfare worker, and contributes to the support of the other activities.

In 1934, 10,783 policies were in force in the group insurance, which represented \$10,927,750 of insurance. Eighty death and disability claims, amounting to \$59,500 were paid during the year. The surplus or reserve fund was \$154,453. The recently formed Credit Union has 500 members and has outstanding loans to employees in excess of \$12,000.

Over 2,000 employees of the Department are participants in a hospital-service plan, which at a cost of 75 cents a month, provides 21 days of hospital care in any one contract year.

The medical and health committee was formed to investigate the advisability

of establishing a cooperative organization to secure medical diagnosis for its members and medical service as well.

The functions of the rent and housing committee are to aid new employees to find satisfactory housing, to investigate the possibility for a cooperative apartment house for employees of the Department, and to organize a community project for the cooperative erection of individual homes at a moderate cost. A site in



Virginia within a few minutes' drive of the Department has been selected, and construction of the first group of homes is under way.

The Musical and Dramatic Guild was formed by employees "interested in music and the drama and desiring to express that interest in good fellowship." The activities of the guild are carried out through three major groups, choral, entations, open to employees, at which the total attendance exceeded 4,000. The Athletic and Recreational Association was formed to promote and foster athletic and recreational activities among our employees. Sections have been formed according to diversity of interest, ranging from aviation and baselyall to chess and pitching horseshoes. It is estimated that upwards of 2,000 employees are active participants in the various activities of the association.





REPORT OF THE DIRECTOR OF PERSONNEL, 1936

United States Department of Agriculture, Office of Director of Personnel, Washington, D. C., September 30, 1936.

Hon. Henry A. Wallace, Secretary of Agriculture.

Dear Mr. Secretary: Herewith I submit a report of the work in the Office of Personnel for the fiscal year ended June 30, 1936. Sincerely yours,

W. W. STOCKBERGER, Director.

INTRODUCTION

The ultimate objective of personnel administration is the maximum utilization of our human resources. Progress toward this end is conditioned by our knowledge of the nature and characteristics of these resources, and by our ability to devise and apply adequate methods for their development. A major function of the Office of Personnel, therefore, is to sponsor and promote every legitimate measure which will contribute to the efficiency, morale, and general welfare of our employees, and to effectuate a reciprocal and sympathetic appreciation, by supervisory officials and the rank and file, of their respective points of view.

That personnel administration is a definite part of supervision, whatever its degree, is not always clearly recognized. The central Office of Personnel fornulates general personnel policies, coordinates personnel procedure in the several branches of the Department, and serves as a general clearing house on personnel matters, but the results depend upon the nature of the relationship established in that narrow zone of contact between supervisor and supervised. Personnel administration will be successful to the extent that line supervisors are made conversant with approved personnel procedures, and are held responsible for their versant with approved personnel procedures, and are held responsible for their understanding and use.

Experience indicates that the development of bureau personnel offices, with corresponding decentralization of personnel administration, promotes compliance with personnel policies and enforcement of proper personnel practices. In bureaus which have large field forces, organized into regional administrative units, it is advantageous to further decentralize personnel administration by the establishment of regional personnel offices, subordinate and responsible to the bureau office. Such offices are in a favorable position to maintain close contact with field supervisors, to advise them of their personnel responsibilities, and to aid them in the solution of the numerous personnel problems which grow out of the relationships between the employee and his supervisor. Experience indicates that the development of bureau personnel offices, with

CAREER TRAINING

The securing of new and acceptably qualified incumbents for vacant positions at the higher levels of responsibility is a problem of increasing difficulty. This indicates the desirability of a more critical examination of the educational background of future entrants into the service, and also points to the necessity for providing a systematic program of training through which active-minded employees could acquire a better understanding of the fundamental principles of management, and also broaden their knowledge of the interrelations of depart management and also broaden their knowledge of the interrelations of departmental operations and functions. Career training should prove attractive to competent, younger employees if provision is made for security of tenure, reasonable compensation, and opportunity for promotion.

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PREVENTIVE MEDICAL SERVICE

Elsewhere in this report it is shown that during the calendar year 1934 employees stationed in Washington were absent from duty on account of illness a total of 51,230 days. Assuming that the average annual salary of the employees concerned was only \$1,500, this represented a loss in services having a salary value of approximately \$245,000. There are good reasons for believing that the establishment of a preventive medical service would result in a substantial reduction in the number of workdays lost and an improvement in the general health of many employees ber of workdays lost and an improvement in the general health of many employees now suffering, perhaps unconsciously, from remediable defects. For this purpose early provision should be made for the employment of a full-time medical officer and an adequate nursing staff.

APPOINTMENTS, SEPARATIONS, AND PROMOTIONS

The number of persons holding formal appointments in the Department was increased by 9,442 during the past fiscal year. On June 30, 1936, there were 53,522 persons under appointment as compared with 44,080 at the close of the fiscal year 1935. The Soil Conservation Service, having 1,853 employees on June 30, 1935, had increased its force to 5,635 by June 30, 1936, a net gain of 3,782, and in addition the Emergency Conservation Work employees of the Soil Conservation Service were given formal appointments during the year, and this force servation Service were given formal appointments during the year, and this force on June 30, 1936, included 4,824 employees, so practically all the gain in the personnel of the Department during the fiscal year occurred in these organizations. The Agricultural Adjustment Administration, which had 6,136 employees on June 30, 1935, decreased its force to 5,493 by June 30, 1936, a loss of 643. Personnel data for the last 5 years are shown in table 1

nel data for the last 5 years are shown in table 1.

Table 1.—Personnel activities of the Department of Agriculture, 1932-36

	Employees	on rolls of D	epartment	-		Separations	
Year ended June 30	Depart- mental service	Field service	Total	Field stations	Employees appointed	from the Depart- ment	
1932	5, 664 5, 521 10, 032 11, 437 11, 434	1 21, 764 2 21, 023 2 28, 591 3 32, 643 4 42, 140	27, 428 26, 544 38, 623 44, 080 53, 522	1, 451 1, 451 1, 451 1, 864 1, 864	6, 612 3, 915 3 31, 434 4 29, 092 4 30, 634	7, 425 4, 721 4 19, 355 7 23, 635 10 21, 192	

- Includes 78 in Foreign Service.
 Includes 80 in Foreign Service.
 Includes 11,667 in Agricultural Adjustment Administration.
 Includes 6,647 in Agricultural Adjustment Administration.
 Includes 52 in Foreign Service.
 Includes 8,249 in Agricultural Adjustment Administration.
 Includes 7,456 in Agricultural Adjustment Administration.
 Includes 52 in Foreign Service.
 Includes 5,186 in Agricultural Adjustment Administration.
 Includes 5,821 in Agricultural Adjustment Administration.

On June 30, 1936, there were 1,382 collaborators serving without compensation who are not included in table 1.

The turn-over of permanent employees during the fiscal year 1936 was 6.88 percent as compared with 7.19 percent during the fiscal year 1935, 10.63 percent during 1934, 3.88 percent during 1933, and 5.98 percent during 1932. The apparent decrease in the turn-over during the fiscal years 1935 and 1936 as compared to 1934 is accounted for by the fact that during the fiscal year 1934 employees apparent decrease and the first percent during the fiscal year 1934 employees apparent of the fact that during the fiscal year 1934 employees apparent during the fiscal year 1935 and 1936 was 6.88 percent during 1935, 10.63 percent during 1934, 3.88 percent during 1933, and 5.98 percent during 1932. The apparent decrease in the turn-over during the fiscal year 1935 and 1936 was 6.88 percent during 1934, 3.88 percent during 1933, and 5.98 percent during 1932. The apparent decrease in the turn-over during the fiscal year 1935 and 1936 was 6.88 percent during 1934, 3.88 percent during 1933, and 5.98 percent during 1932.

pared to 1934 is accounted for by the fact that during the fiscal year 1934 employees appointed regularly from civil-service certificates for a probationary period for the duration of the work were counted as permanent in 1934, whereas during the years 1935 and 1936 they were classed as temporary or emergency employees. The fiscal year 1936 is the first year since the passage of the Economy Act of June 30, 1932, in which administrative promotions or promotions within the grade, were possible. During this year there were 10,815 promotions, both within the grade and from grade to grade, compared with 3,764 during the fiscal year 1935, and 914 in the fiscal year 1934. Promotions during 1934 and 1935 were from grade to grade only

from grade to grade only. During the year 413 formal applications for civil-service positions were received and circulated throughout the Department, as compared with 410 during 1935.



3

During the calendar year 1934 annual leave of 15 days was allowed for the full year, together with the leave accumulated from 1933. Statistics have been compiled for annual and sick leave for the calendar year 1934. The average annual leave taken by the men and women in Washington was 11.9 days, whereas the employees in the field took an average of 10.2 days.

As indicated in previous reports, the decrease in the amount of annual leave to 15 days did not materially affect the amount of sick leave taken by the employees of the Department. During the calendar year 1934 the average sick leave taken by employees in Washington was 7.5 days, an increase of 0.2 day over 1933, and the same as the average for the last 8 years. Table 2 shows the distribution of employees according to the number of days of annual or sick leave used, and the total number of days of leave in each classification. These figures contradict the frequently repeated statement that employees are accustomed to use their entire frequently repeated statement that employees are accustomed to use their entire allowance of leave. Only 3.9 percent took the maximum amount of sick leave. There were 1,126 employees who used more than 15 of the allowable 30 days of sick leave. The total number of days of sick leave taken by this group was 26,489. Hence 16.5 percent of the employees used 51.7 percent of the total sick leave taken leave taken.

Table 2.—Distribution of employees according to number of days of annual and sick leave used, calendar year 1935

Annua	lleave		Sick le	ave	
Days taken (number)	Employees 1 Number 189	Total days taken Number	Days taken (number)	Employees ¹ Number 1, 475	Total days taken
1. 2 2. 3. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	136 130 148 144 175 205 228 267 283 406 424 453 503 596 993 400 324 253 185 127 84 57 7	136 260 444 576 875 1, 230 1, 596 2, 136 2, 547 4, 060 4, 664 5, 436 6, 539 8, 344 14, 895 6, 400 5, 508 4, 554 3, 515 2, 540 1, 764 1, 254 759 600 175 260	1 2 3 4 4 5 6 6 7 7 8 9 10 11 1 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 0 9 10 10 10 11 10 10 10 10 10 10 10 10 10	544 538 436 405 303 317 257 243 231 211 187 179 129 98 106 100 102 84 58 55 61 60 60 52 42 40 39 63	544 1, 076 1, 308 1, 620 1, 515 1, 902 1, 799 1, 944 2, 075 2, 110 2, 057 2, 148 1, 677 1, 372 1, 590 1, 600 1, 734 1, 512 1, 100 1, 281 1, 100 1, 281 1, 100 1, 281 1, 100 1, 292 1, 100 1, 300 1, 902 1, 080 1, 092 1, 082 1, 092 1, 827 8, 010
			Total	6, 785	51, 230

¹ Not including employees on temporary status who were not entitled to leave.

Average number of days annual leave, 11.9; average number of days of siek leave, 7.5.

In the field, where the limit of sick leave was 15 days, the average sick leave taken during the year 1934 was 2.6 days, as compared with 8-year average of 2.9 days. Ten percent of the employees in the field took 15,101 days of sick leave and 90 percent used only 14,160 days.

During the calendar year 1934, 21.7 percent of the employees in Washington did not take any sick leave. In the field, for the same year, only 5.3 percent took the maximum amount and 54 percent took none. The 8-year average of



employees taking the full amount of sick leave is 5.3 percent for Washington and 6.2 percent for the field, whereas 26 percent of the employees in Washington and 52 percent of the field force used no sick leave.

WORK INCIDENT TO APPOINTMENTS, TRANSFERS, AND PROMOTIONS

Changes affecting personnel in the Department required contacts with the Civil Service Commission, and authorizations affecting appointments, promotions, transfers, reinstatements, etc., were recorded as indicated in table 3.

Table 3.—Personnel changes in the Department of Agriculture, 1932-36

Item .	1932	1933	1934	1935	1936
Certificates from register. Reinstatement certificates. Certificates for change in status. Transfer certificates. Authorities for temporary appointments. Authorities for extensions of temporary appointments. Authorities for extensions of suspensions. Civil-service examinations requested.	702 212 194 165 462 443 6 26	74 27 108 69 94 66 6 6	1, 510 481 254 465 4, 848 4, 031 3 29	1, 648 416 910 220 740 1, 466 2 110	1, 94 48 1, 38 45 77

¹ The material reduction in this item under previous years may be accounted for by the fact that the various bureaus and offices of the Department have been filling more or less temporary vacancies by probationary, for duration of work, appointments in which cases no extensions of temporary appointments are involved.

RETIREMENT RECORDS

Our records show that 154 employees were retired in accordance with the provisions of the Retirement Act during the fiscal year 1936. Figures showing the retirements for the last 5 years are given in table 4, and the average annuities paid in the various groups are shown in table 5.

Table 4.—Number of employees retired, 1932-36

	Annuity retirements in class				Disability retirements in class				
Year ended June 30	Profes- sional	Subpro- fes- sional	Clerical, adminis- trative, and fiscal	Custo- diai	Profes- sional	Subpro- fes- sional	Cierical, adminis- trative, and fiscal	Custo- dial	Cases dis- posed of
1932	22 81 51 46 29	41 132 63 65 50	13 22 58 24 18	9 28 24 12 6	8 9 12 10 11	17 23 12 14 19	8 19 28 29 18	10 15 11 5 3	128 329 259 205 154

Table 5.—Averages of the annuities in the various groups, 1932-36

Group	1932	1933	1934	1935	1936
Professional and scientific Subprofessional Cierical, administrative, and fiscal Custodial	\$1, 100, 77	\$1, 114. 04	\$1, 102. 22	\$1, 039, 81	\$1, 068, 59
	972, 67	1, 012. 91	946. 81	960, 08	. 990, 43
	981, 88	963. 67	946. 83	826, 35	. 865, 08
	698, 57	695. 98	757. 72	728, 50	. 654, 05

The average age of employees retired on account of disability was 53.7 years, and the minimum annuity granted was \$200.04. The largest annuity granted on retirement because of age was \$1,445.88. This was the increased annuity with forfeiture. Had the employee elected a life annuity the amount annually received would have been \$1,269.48. Of the 154 employees granted annuities, only 48



had 30 or more years of service. Of the 48, 35 were retired on account of age, 10 for disability, and 3, reduction of force. Only seven employees availed themselves

of the optional-retirement clause.

The following continuances in the service beyond retirement age were granted:

A principal highway engineer and an associate economic geologist in the Bureau of A principal highway engineer and a principal hotanist in the Bureau of Plant

Public Roads; a senior pathologist and a principal botanist in the Bureau of Plant Industry; and a principal soil scientist in the Bureau of Chemistry and Soils.

In addition to the above, the retirement section forwarded to the Civil Service Commission 709 applications for refund of retirement deductions, and 4,328 of the Civil Service Commission Master Retirement Record Cards No. 2806 for employees the registred transformed to other catalylichements. ployees who resigned, transferred to other establishments, or separated for other

reasons.

There were 221 employees who obtained credit for past temporary or excepted service as provided for under section 9 of the act of May 29, 1930, and redeposited

the amounts previously refunded. The quinquennial valuation report for the Civil Service Commission shows the total civil-service retirement and disability fund deductions remaining to the credit of employees of this Department on June 30, 1935, to be \$11,402,599.34.

INVESTIGATIONS

One of the outstanding achievements during the past year was the inauguration of periodical detailed inspections of field stations and offices of the Department. The purpose of such inspections is twofold; namely, to discover existing cases of The purpose of such inspections is twofold; namely, to discover existing cases of fiscal irregularities, inefficiency, and mismanagement, and to prevent similar cases in the future. It is believed that these inspections will result in material savings to the Department by eliminating or greatly reducing inefficiency, mismanagement, and waste. In the conduct of the inspections every phase of the business operations is checked, special attention being given to pay-roll and purchase vouchers. In fact, all receipts and disbursements are checked, as are property and other necessary control records. Vendors' records are also checked against purchase orders and youchers. purchase orders and vouchers.

During the year detailed inspections were made at 24 field stations. number of such inspections may be attributed to limited personnel; to the fact that a number of stations had been in operation for many years without previous inspection and audit, which made it essential for the investigators to remain at such stations for a longer period of time than would otherwise have been necessary to complete their work; and to the necessity for taking investigators off this type of work for the purpose of having them conduct important special investigation. tions. Furthermore in many instances the investigators were hampered in their work by the lack of adequate records. In such cases recommendations were with respect to the types of records which should be maintained in the

The results of the detailed inspections made during the past year amply demonstrated the need for continuing and expanding this type of work. Many fiscal irregularities, some of a serious nature, were discovered and stopped. Some cases of inefficiency, maladministration, and violation of Department regulations were discovered. Appropriate disciplinary action was taken in all cases, and reports were submitted to the Comptroller General when this was warranted by the facts. Some of the cases were of such a serious nature that they were reported also to the

Attorney General for appropriate action.

In numerous cases the investigators were of service to field officials by giving them accurate and helpful information and advice with respect to their problems, and this type of assistance will form an important part of the investigators' duties

in the future. In addition to the detailed inspections of field stations and offices, 130 special investigations were conducted during the past fiscal year, most of which were personnel cases, and several alleged violations of regulatory laws administered by the Department were investigated. During the past year several hundred personnel recommendations submitted by the various bureaus were reviewed, a large some recommendation of which were for the imposition of disciplinary penalties. In review proportion of which were for the imposition of disciplinary penalties. ing these recommendations consistent effort has been made to see that like penalties were imposed for like offenses.

Many other services have been rendered including conferring with and advising bureau officials with respect to personnel problems and giving helpful advice to employees who felt that they had received unjust treatment.



CLASSIFICATION OF POSITIONS

During the fiscal year the classification staff operating under the Classification Act of 1923, as amended, has intensified its review of new positions and duty changes resulting from reorganization in the Washington service; has revised numerous obsolete descriptions of work; has reviewed and effected a greatly increased number of tentative classifications of the field positions; has conducted studies on organization and brought up to date the organization charts of the various bureaus and offices of the Department; has extended its activities by a personal inspection of the duties performed in some of the more important field personal inspection of the duties performed in some of the more important field stations; and has rendered more direct and constant service and advice to bureau

officials in their classification and organization problems.

A total of 7,793 appointments and changes in status of Washington employees were acted upon during the past year. This number does not reflect the many cases reviewed and returned without action. It does, however, show all cases of change in duties and appeal, each of which involves a careful job analysis and recommendation. The number of individual appeals did not increase as it has been possible to give more attention to the individual and group needs than during the past few years.

summary of this activity, insofar as it relates to the personnel in Washington for the past year, is given in table 6.

Table 6.—Appointments and changes in status of employees of the Department of Agriculture, 1932-36

Year ended June 30	Appoint- ments to new posi- tions	Changes in duties	Changes to vacancies	Appeals	Total
1932	187	320	725	23	1, 25
1933	246	143	104	5	49
1934	5, 561	1, 274	2, 329	15	9, 17
1935	1, 634	3, 315	3, 260	45	8, 25
1936	1, 905	3, 698	2, 145	45	7, 79

In addition to those shown in table 6, a greatly increased number of positions have been reviewed from the field service and tentative classifications assigned in accordance with departmental standards. The volume of such transactions increased greatly with the continuation of the emergency funds, the extensive reorganization of the Forest Service and the expansion of the Soil Conservation

The number of individual and office surveys on work assignments has increased and more comprchensive cross-section job-analysis studies have been made possible in the past year. This has aided proposed organization and allocation changes sible in the past year. This has aided proposed organization and allocation changes and has helped to settle numerous grade and salary problems, smoothed out personnel difficulties and effected efficiency in management, as well as economy in financial savings to the Department. The continuation of emergency allotments with the subsequent employment of large numbers in the field service, as well as the normal reorganization of the various bureaus, requires accurate information on all work problems, their relation to the units concerned and the coordination of individual duties to the standardized plan of uniform compensation grades for like services rendered. In addition to this work the division has aided in the establishment of fair and adequate regional wage scales for certain unclassified field positions.

The inspection of field positions, although restricted because of limited personnel, has been made in representative offices of the Forest Service, Soil Conservation Service and in certain departmental offices in New York City and Balti-In each case important classification information was secured and grade ary discrepancies adjusted. The results of such inspections show that they and salary discrepancies adjusted. The results of such inspections show that they aid in improving the morale of the employees, assist the field officers in their problems of personnel adjustment, avoid duplications in employee assignment and

result in consequent savings to the service.

Constant advice also is rendered to bureau officials on questions of classification procedure, levels of duty assignment, division of employee responsibility, job levels and wage scales, and related problems of organization. These services create a better understanding of the problems of classification and aid the Department in maintaining fair and uniform standards of work and pay throughout its

numerous agencies.



EMPLOYEE ACTIVITIES

The Office of Personnel has continued sponsorship of the numerous employee activities which may be grouped as follows: Educational, welfare, and social and recreational. On March 27, 1936, the Welfare Association published a pamphlet of 21 pages in which the various employee activities of the Department were described in detail. So far as possible a copy of this pamphlet has been placed in the hands of each new employee who has entered the service in Washington since the date of publication.

These activities have exerted a very wholesome influence upon the morale of employees, and have developed a more democratic spirit in their relationships: They have also made of the Department a pleasanter place in which to live and work:

U. S. GOVERNMENT PRINTING OFFICE: 1936



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REPORT OF THE DIFECTOR OF PERSONNEL, 1937

UNITED STATES DEPARTMENT OF AGRICULTURE, Office of Director of Personnel, Washington, D. C., September 30, 1937.

Hon. HENRY A. WALLACE, Secretary of Agriculture.

DEAR MR. SECRETARY: Herewith I submit a report of the work in the Office of Personnel for the fiscal year ended June 30, 1937. Sincerely yours,

W. W. STOCKBERGER, Director.

Personnel work in the Department is visualized as an activity the primary function of which is essentially one of service to the operating agencies. The individual worker is regarded as the critical factor conditioning the performance of individual worker is regarded as the critical factor conditioning the performance of functions for which the administrative officials in the operating agencies are responsible. It follows, therefore, that effective personnel work must go far beyond orderly procedures and record keeping. It must be concerned in the selection, placement, training, and promotion of employees, for their safety and welfare, and for whatever else will increase the satisfaction they derive from their work and contribute to the greatest efficiency obtainable from them.

The ever-widening scope of the activities of the Department with resultant responsibility in relation to the economic and social structure of the Nation emphasizes the need for systematic planning to develop the highest grade of executive and administrative personnel, to devise means for increasing the attractiveness of positions at the higher levels of authority and responsibility, and to check the flow of experienced personnel into industry and private activity which

attractiveness of positions at the higher levels of authority and responsibility, and to check the flow of experienced personnel into industry and private activity which inevitably occurs with every rising tide of prosperity.

The opportunity for a scientific approach to its problems is no less in personnel work than in the physical and biological sciences. Scientific studies of adequate personnel data should yield results of primary importance in determining the factors which condition the socially useful behavior of employees. Personnel research should be the guiding influence in shaping personnel policies, in the exploration of the motivation of our human resources, and in the direction of human effort toward the attainment of the objectives of our organization.

IN-SERVICE TRAINING

There is a growing awareness of the importance of training within the service, and constructive training programs deserve the sympathetic support of all who are concerned for the improvement of performance and for raising the level of competence in the Department. Some of the more general aims of training are to acquaint new employees with the purpose and work of the agency in which they are employed, to increase skill in the performance of the work to which they are assigned, to discover employees fitted for advancement, and to prepare them to undertake more difficult or more responsible assignments of duties and responsibilities. Fruitful results should follow wider acceptance of the dogma that the public interest will be enhanced through carefully planned programs of training designed to develop latent abilities of employees and to inculcate in them habits for continuing self-education. The formal or academic phases of training may well be left to the schools, colleges, and universities, and efforts focused on types of left to the schools, colleges, and universities, and efforts focused on types of training designed (1) to increase proficiency in selected skills, and (2) to promote understanding of the concepts and objectives of specialized lines of work and an appreciation for the interrelationships which must be observed in fitting them into the frame of a major activity. Progress toward these ends would be materially hastened through the establishment of a central division of training to coordinate existing training work and to aid in the development of new and needed programs for additional training.

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SAFETY WORK

Late in the year funds were authorized for safety work and the Division of Safety was accordingly established in this Office. The chief of this Division will make detailed studies of the accident problem in the Department, install a uniform system of recording and reporting accidental injuries to employees, and cooperate with the interdepartmental safety council and with representatives from each of the bureaus in the development of safety work in the Department.

APPOINTMENTS, SEPARATIONS, AND PROMOTIONS

There were 60,229 employees serving under formal appointment by the Secretary of Agriculture on June 30, 1937, as compared with 53,522 on June 30, 1936, or an increase of 6,707 during the fiscal year. The number of employees in the Soil Conservation Service was increased from 5,635 to 8,111 by June 30, 1937, a net gain of 2,476. The Resettlement Administration was transferred to the Department of Agriculture on January 1, 1937, and formal appointments were issued to the Washington personnel, which on June 30, 1937, numbered 2,329. A number of Emergency Conservation Corps workers in the various bureaus of the Department were given formal appointments during the year. The increase in the number of employees of the Forest Service holding appointments from 5,558 to 7,383, a net gain of 1,825, was largely due to these E. C. W. appointments. The increase in the Soil Conservation Service, the addition of the Resettlement Administration and the formal appointments of a large number of E. C. W. employees, accounts for practically all the gain in the personnel of the Department during the year. It is interesting to note that on June 30, 1932, there were 27,350 persons holding formal appointments in the Department of Agriculture, as compared with 60,229 on June 30, 1937.

The personnel of the Agricultural Adjustment Administration was decreased form 5,402 and 5,1026, to 4,204 by June 20, 1027, a reduction of 1,009.

The personnel of the Agricultural Adjustment Administration was decreased from 5,493 as of June 30, 1936, to 4,394 by June 30, 1937, a reduction of 1,099. There were 16,447 employees in the field service of the Resettlement Administration on June 30, 1937, but these figures are not included in the computations because these employees did not hold formal appointments by the Secretary of Agriculture

Agriculture. Personnel data for the last 5 years are shown in table 1.

Table 1.—Personnel activities of the Department of Agriculture, 1933-37

	Emplo	yees on roll partment	s of De-	Field	Employ-	Separa-	
Year ended June 30	Depart- mental service	Field service			ees appointed	from the Depart- ment	
1933	5, 521 10, 032 11, 437 11, 382 10 13, 371	1 21, 023 1 28, 591 4 32, 643 7 42, 140 11 46, 858	26, 544 38, 623 44, 080 53, 522 60, 229	1, 451 1, 451 1, 864 1, 864 2, 924	3, 915 ² 31, 434 ³ 29, 092 ⁸ 30, 634 ¹² 34, 561	4, 721 3 19, 355 6 23, 635 9 21, 192 13 27, 854	

Includes 80 in Foreign Service.
Includes 11,667 in Agricultural Adjustment Administration.
Includes 6,647 in Agricultural Adjustment Administration.
Includes 52 in Foreign Service.
Includes 7,459 in Agricultural Adjustment Administration.
Includes 7,459 in Agricultural Adjustment Administration.
Includes 52 in Foreign Service.
Includes 5,186 in Agricultural Adjustment Administration.
Includes 5,821 in Agricultural Adjustment Administration.
Includes 2,329 in Resettlement Administration.
Includes 88 in Foreign Service.
Includes 1,336 in Agricultural Adjustment Administration.
Includes 2,435 in Agricultural Adjustment Administration.

On June 30, 1937, there were 1,634 collaborators serving without compensation who are not included in table 1.

The turn-over of permanent employees during the year was 5.12 percent, as compared with 6.88 percent during the preceding year, 7.19 percent during 1935, 10.63 percent during 1934, and 3.88 percent during 1933.

During the year there were 11,960 promotions, as compared with 10,815 in 1936, and 3,764 in 1935. Promotions during 1935 were from grade to grade only, under the Economy Act of June 30, 1932, while in 1936 and 1937 administrative promotions or promotions within the grade were possible, and the number given for these fiscal years includes promotions both within the grade and from grade to grade.

RECORD OF LEAVE

Employees were allowed annual leave at the rate of 15 days for the full year in 1935, together with the leave accumulated from 1933 and 1934. Data are given in table 2 to show the distribution of the annual and siek leave used in Washington in the calendar year 1935. Men and women in Washington averaged 14.4 days annual leave, as compared with 11.9 days in 1934. Employees in the field averaged 11.4 days, as compared with 10.2 days in the previous year.

Table 2.—Distribution of employees in Washington according to number of days of annual and sick leave used, calendar year 1935

	Annua	i leave	Sick	leave		Annua	l leave	Sick	leave
Days taken (number)	Em- ploy- ees !	Total days taken	Em- ploy- ees 1	Total days taken	Days taken (number)	Em- ploy- ees 1	Total days taken	Em- ploy- ees 1	Totai days taken
	Number	Number	Number	Number		Number	Vumber	Number	Number
)	287	0	1,617	0	17		10, 404	133	2, 261
1	93	93	580	580	18.		8, 640	110	1, 980
2	94	188	558	1, 176	19		7, 999	96	1, 824
3	111	333	475	1, 425	20		7, 460	91	1,820
1		448	462	1.848	21		5, 124	00.00	1, 617
5	123	615	399	1, 995	22	206	4, 532	85	1, 870
3	181	1, 086	352	2, 112	23	174	4,002	65	1, 495
J 	185	1, 295	316	2, 212	24	140	3, 360	65	1, 584
	103	1, 514	328	2,621	0.0	105	2, 625	67	1, 675
	262	2, 358	274	2, 466				60	1, 560
10	262	2, 610	264	2, 400	26	66	2,028	64	1, 300
11	327		267				1,782	58	
12	350	3, 597		2, 937 3, 528	28	31	1, 512	138	1,624
		4, 200	294				899		
13	461	5, 993	173	2, 249	30 3	47	1,488	490	14, 700
14	626	8, 764	209	2, 926	(D-4-1	11 000	100 710	0, 500	70 100
5		17, 190	163	2, 445	Total	8, 502	122, 713	8, 502	75, 159
16	659	10, 544	141	[2, 256]					

 $^{^1}$ Not including employees on temporary status who were not entitled to leave. 2 30 and over for annual leave only.

The average sick leave used by employees in Washington in 1935 was 8.8 days, an increase of 1.3 days over 1934, and an increase of 1.2 days over the average for the previous 8 consecutive years. Only 5.8 percent of the employees took the maximum amount of sick leave. There were 1,741 employees who used more than 15 of the allowable 30 days of sick leave. The total number of days of sick leave taken by this group was 41,996. Hence 20.5 percent of the employees used 56 recreated sick leave taken. percent of the total sick leave taken.

In the field, where the limit of siek leave was 15 days, the average sick leave taken during 1935 was 2.7 days, as compared with the past 8-year average of 2.9

days. Ten and one-half percent of the employees in the field took 19,185 days of sick leave and 89.5 percent used only 18,276 days.

During the ealendar year 1935, 19 percent of the employees in Washington did not take any sick leave. In the field for the same year, only 5.2 percent took the maximum amount and 52 percent took none. The past 8-year average of employees taking the full amount of siek leave is 5.5 percent for Washington and 6 percent for the field; whereas 25 percent of the employees in Washington and 52 percent. for the field; whereas 25 percent of the employees in Washington and 52 percent of the field force used no sick leave.

WORK INCIDENT TO APPOINTMENTS, TRANSFERS, AND PROMOTIONS

During the year, 760 formal applications for eivil service positions were received from all sources and circulated throughout the Department, as compared with 413 during 1936.

Average number of days annual leave, 14.4; average number of days of sick leave, 8.8.



It has always been the general policy of the Department of Agriculture to fill vacancies by promotion of employees in the service of the Department whenever possible; but on May 26, 1937, a procedure for carrying out this policy was placed in effect by the issuance of instructions to all bureaus and offices, with respect to the filling of permanent positions in Washington. The plan announced provided for the advertisement of vacancies on bulletin but and the circularization of the plan announced provided for the advertisement of vacancies on bulletin but and the circularization of the plant and the circularization of th appropriate notices throughout the Department. During June, 24 vacancies were announced and 133 applications were received from employees. These applications were forwarded for consideration to the office or offices where the vacancies existed. Notwithstanding the short time this procedure has been in operation, it has demonstrated its value in emphasizing the policy of filling vacancies from within the course. cies from within the service.

Personnel matters which required contacts with the Civil Service Commission. and the procurement of authorities for personnel changes are shown in table 3.

Table 3.—Personnel changes in the Department of Agriculture, 1933-37

Item	1933	1934	1935	1936	1937
Certificates from register Reinstatement certificates Certificates for change in status. Transfer certificates Authorities for temporary appointments. Authorities for extensions of temporary appointments. Authorities for extensions of suspensions Civil-service examinations requested.	74 27 108 69 94 66 66	1, 510 481 254 465 4, 848 4, 031 3 29	1, 648 416 910 220 740 1, 466 2 110	1, 948 481 1, 388 452 771 1 270 3 124	1, 425 442 2, 166 267 4, 700 941 7 65

 1 The material reduction in this item under previous years may be accounted for by the fact that the various bureaus and offices of the Department have been filling more or less temporary vancancies for duration of work by probationary appointments in which cases no extensions of temporary appointments are involved.

RETIREMENTS

During the year 43 employees in the professional service were retired, 29 because of reaching the age for retirement, 8 on account of disability, 4 having rend-

cause of reaching the age for retirement, 8 on account of disability, 4 having rendered 30 or more years of service and retiring under the optional provision upon reaching the age 2 years earlier than the compulsory age limit, and 2 incident to reduction in force. The average annuity for the entire group was \$1,049.04.

In the subprefessional service 62 employees were retired, 31 on account of age, 20 because of disability, and 11 by optional retirement. The average annuity for this group was \$1,027.02. The 38 retirements in the clerical, administrative, and fiscal service included 14 on account of age, 20 because of disability, 3 by optional retirement, and 1 by reduction in force. The average annuity was \$887.82. Of the 10 retirements in the custodial service, 4 were separated on account of age, 5 for disability, and 1 by optional retirement. In this group the average annuity was \$708.79. average annuity was \$708.79.

The amount of annuity is based on salary and length of service. The minimum annuity granted was \$187.92. There are two types of annuity, either of which may be chosen by the employee. One is known as life annuity and provides for the payment to the employee's estate of the unexpended balance to his credit in the payment to the employee's estate of the unexpended balance to his credit in the retirement fund, in the event of his death; the other is designated increased annuity with forfeiture; that is, upon the death of the employee the unexpended balance remains in the retirement fund. During the year, the largest life annuity was \$1,323.48, and the largest increased annuity with forfeiture was \$1,442.64.

Continuances in the service beyond retirement age were granted to a principal veterinarian in the Bureau of Animal Industry; a principal agronomist, a principal pathologist, and a senior pathologist in the Bureau of Plant Industry; a chief accountant and auditor in the Office of the Director of Finance; a senior forester in the Forest Service; and a regional law officer in the Office of the Solicitor.

There were 384 applications for service credit and 1,024 applications from employees separated from the service for refund of their retirement deductions were certified to the Civil Service Commission for adjudication. In addition, 3,302 master retirement record cards No. 2806 were completed and forwarded to the Civil Service Commission for esigned, transferred to other establishments, or were separated for other reasons.

Figures showing the retirements for the last 5 years are given in table 4, and the average annuities paid in the various groups are shown in table 5.



TABLE 4.—Number of employees retired, 1933-37

	Annuity retirements in class				Disability retirements in class				
Year ended June 30	Profes- slonal	Sub- profes- sional	Cleri- cal, admin- istra- tive, and fiscal	Custo- dial	Profes- sional	Sub- profes- sional	Clerical, administrative, and fiscal	Custo- dial	Cases dis- posed of
1933	81 51 46 29 35	132 63 65 50 42	22 58 24 18 18	28 24 12 6 5	9 12 10 11 8	23 12 14 19 20	19 28 29 18 20	15 11 5 3 5	329 259 205 154 153

Table 5.—Averages of the annuities in the various groups, 1933-37

Group	1933	1934	1935	1936	1937
Professional and scientific Subprofessional Clerical, administrative, and fiscal Custodial	\$1, 114, 04	\$1, 102, 22	\$1, 039, 81	\$1, 068, 59	\$1, 049, 04
	1, 012, 91	946, 81	960, 08	990, 43	1, 027, 02
	963, 67	916, 83	826, 35	865, 08	887, 82
	695, 98	757, 72	728, 50	651, 05	708, 79

CLASSIFICATION OF POSITIONS

The classification staff operating under the Classification Act of 1923, as amended, has continued to review new positions and duty changes resulting from the growth and reorganization of the Washington service; has expanded its infor-mation and aid to a greater number of tentative classifications of field positions; has continued to keep up-to-date organization charts of the various bureaus and offices of the Department and has assisted the bureaus in formulating new organization plans; has developed an in-service training course on classification techniques; has begun the preparation of a field classification manual; has started special studies on occupational groups with accompanying cross-section charts; has personally inspected a greater number of field stations; has attended and participated in national personnel meetings; and has rendered direct and constant service and advice to the bureaus in preparing an increased number of job descrip-

service and advice to the bureaus in preparing an increased number of job descriptions, charts, and related classification matters.

A total of 6,339 appointments and changes in status in Washington employees were acted upon during the past year. The number recorded is slightly less than for the preceding year because of the invalidation of portions of the Agricultural Adjustment Act and the subsequent decrease in personnel. This in a way was counterbalanced by the addition of the Resettlement Administration, formerly an independent agency. In addition many eases were reviewed and returned without action. The number does, however, reflect all cases that involve change in duties, or an appeal for reallocation. Each of these involves a careful job analysis. There is a marked decrease in the number of anneals, as more attention is given There is a marked decrease in the number of appeals, as more attention is given

each year to the individual and group needs of the employees.

A summary of this activity, insofar as it relates to the personnel in Washington for the past 5 years, is given in table 6.

Table 6.—Appointments and changes in status of employees of the Department of Agriculture, 1933-37

Year ended June 30	Appoint- ments to new posi- tions	Changes in duties	Changes to vacan- cies	Appeals	Total
1933	246	143	104	5	498
1934	5, 561	1, 274	2, 329	15	9, 170
1935	1, 634	3, 315	3, 260	45	8, 254
1936	1, 905	3, 698	2, 145	45	7, 793
1937	911	4, 002	1, 403	23	6, 339



In addition to those shown in table 6, a large number of positions have been reviewed from the field service and tentative elassifications assigned according to departmental standards. The volume of such transactions has been gradually reduced over the preceding year, as the reorganization of the Forest Service and the expansion of the Soil Conservation Service have now reached a near-normal level.

Individual and office surveys on duty assignments have been expanded during the past year, and have yielded data of value to the bureaus and to the central personnel office. Cross-section studies on grade levels, duty series for selected types of work, and special wage and occupational studies have been made as an aid in the solution of organization and salary problems. Data on wages and duties of unclassified positions have been accumulated. This information has helped in the solution of personnel problems, increased the efficiency of management through improved employee relations and morale, and resulted in financial savings to the bureaus. Studies have been made on certain lines of work and pay of non-Government employees operating under employee organizations, and the resulting recommendations have been of service in establishing fair and adequate wage scales for such workers.

adequate wage scales for such workers.

Extensive inspections of field positions in the vicinity of Washington were undertaken and the foundations laid for maintaining standard wage and job assignments. Representative field offices of the Soil Conservation Service and Forest Service were visited in widely separated regions of the country and valuable classification information secured. Such inspections provide first-hand information that serves properly to evaluate the work performed, enables grade and salary adjustments to be made, encourages the employees, helps the supervisors with their more difficult cases, avoids duplication of work assignment, and provides material savings to the Department. Classification is primarily concerned with perpetuating the principle of equal pay for equal work.

During the past year a 6-week group study instruction course was offered to

During the past year a 6-week group study instruction course was offered to those concerned with classification matters in the bureaus. This was well attended and helped to increase the interest in the services of classification to the

Department.

The staff is constantly called upon to render advice to bureau officials in questions of classification procedure, both in Washington and in the field. Trained assistants who are familiar with the entire Department structure conduct studies, visualize requirements, and render recommendations as to duty assignments, evaluation of responsibilities, job descriptions, job levels, wages, and related problems of organization. With the large number of employees in the field service, the materials collected from each field trip or office survey on wages, duties, and related facts are invaluable in maintaining fair and uniform standards of work and pay throughout the several agencies of the Department.

INVESTIGATIONS

During the year a total of 888 recommendations, most of which were for the imposition of disciplinary penalties on account of delinquency, misconduct, and fiscal and other irregularities, received consideration by the Division of Investigations. Eighty-seven personnel investigations and 22 miscellaneous investigations were conducted, and 3,580 Agricultural Adjustment Administration contracts were investigated.

A substantial number of the investigations resulted in the recovery of money due the Government from employees and others as a result of payments being made erroneously or of Government checks falling into the hands of persons other

than the payees.

It is highly desirable that personnel investigations, involving delinquency, misconduct, and fiscal and other irregularities on the part of employees, be conducted with as little delay as possible, in order that corrective measures may be promptly taken with a view to eliminating from the service dishonest or otherwise undesirable employees. Prompt handling and settlement of such cases result in removing suspicion from honest employees, strengthening morale, aiding in the maintenance of proper discipline, and eliminating waste and inefficiency, all of which are essential to effective administration, efficient service, and just treatment of employees.

Very little headway was possible during the year in periodical inspections of

field stations, because of the demands made on time and personnel by requests for special investigations and because of the limited number of properly instructed and trained investigators available for this work. Only 14 such inspections were



made. It is believed that with an adequate number of properly trained investigators, well versed in fiscal procedure, regulations, etc., it would be possible to prevent a great many eases of fiscal and other irregularities and to discover others before they became well-established practices. Such a force of investigators would also be of material assistance to field officials in the varied and complicated fiscal operations with which they must deal from day to day.

The work of the year resulted in 964 separate personnel actions, as follows:

Suspension without pay pending investigation.	40
Preferment of formal charges	28
Dismissal as a result of formal charges	. 18
Reprimand by chief of bureau	. 21
Reprimand by Secretary	
Reduction in grade and/or salary	. 13
Reduction in grade and/or salary, and reprime by Secretary	. I
Reduction in grade and/or salary, reprimend by Secretary, and transfer	1
Suspension without pay	
Suspension without pay and reprimand by Secretary	. 39
Suspension without pay, reprimand by Secretary, and reduction in grade and/or salary.	3
Suspension without pay, reprimand by Secretary, and transfer	2
Suspension without pay, reprimand by Secretary, reduction in grade and/or salary, and transfer	. 1
Appointment terminated with prejudice	. 91
Appointment terminated without prejudice	379
Resignation accepted with prejudice	57
Resignation accepted without prejudice	142
Action taken for other than disciplinary reasons	. 100
Totai	963

EMPLOYEE ACTIVITIES

The interest and participation of the personnel in the numerous emplopee activities has continued unabated. The Welfare Association has rendered financial assistance to several activities which were not self-supporting, and also made possible the issuance of a new and attractively illustrated edition of the booklet describing employee activities, which was distributed throughout the

Department.

These activities offer to employees opportunities in education, recreation, and amusement, facilitate the extension of acquaintance between different groups of workers, and promote the development of departmental spirit.

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REPORT OF THE DIRECTOR OF PERSONNEL, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE, OFFICE OF DIRECTOR OF PERSONNEL, Washington, D. C., June 30, 1938.

Hon. HENRY A. WALLACE,

Secretary of Agriculture.

DEAR MR. SECRETARY: Herewith I submit a report of the work in the Office of Personnel for the fiscal year ended June 30, 1938.

W. W. STOCKBERGER, Director.

Personnel administration in the Department is characterized by a positive and dynamic program formulated to meet the growing and ever-changing needs of the functional work performed in the various operating agencies. The work is a combination of centralized functional order and arrangement of duties coordinated with a decentralized system established in each of the bureaus and agencies. The policies and activities of the Office of Personnel must be entirely reflective of the project assignments and the riging poods of the Deportment as reflective of the major assignments and the rising needs of the Department as a whole. It is not concerned with the individual functions but with the combination of functions which comprise the entire institution. The Personnel Office tion of functions which comprise the entire institution. The Personnel Office assumes considerable responsibility for selection and placement of personnel, in the promotion of employees, in the general departmental program of safety and welfare, and in all of the related phases of management which increase the satisfaction of the workers and at the same time contribute greater efficiency to the working plans of the Department. This in no way removes the original control vested in the bureaus but enables the Office of Personnel to offer them more assistance in the performance of their personnel work. Together the bureaus and the Office are raising the management of personnel beyond the earlier stages where the work consisted only of orderly procedure and record keeping. The trend, like that of society and enterprise, is away from individual keeping. The trend, like that of society and enterprise, is away from individual keeping. The trend, like that of society and enterprise, is away from individual and toward group control. It affords opportunities for coordinating activities with resulting benefit to all. Through division of labor and responsibility, constant progress is made in developing higher standards in personnel work. These protect the morale of employees in the Department and lend encouragement to more effective administration.

The widening scope of the activities of the Department have brought the

economic and social features of its work ever closer to the immediate needs of the Nation. In order that their services may be responsive to public and the Nation. In order that their services may be responsive to public and national needs and demands, employees who are selected for the work of the Department must be of the highest type as to ability, training, and personal aptitude. To see that appointees satisfactorily meet these requirements is a major responsibility of personnel officers. The work to be done requires able the interview and trained assistants who appropriate the importance of proper administrators and trained assistants who appreciate the importance of proper selection and training of secondary employees in order that they may competent to advance into more responsible positions and to perform the required

competent to advance into more responsible positions and to perform the required techniques thereof in the prescribed and acceptable manner.

There is a growing interest on the part of employees to learn more about the broader phases of the work of the Department, and various agencies afford opportunities for training in existing lines of work or in new ones that from time to time arise. The personnel program is being adapted to meet the recognized need for the coordination of training activities and for the develop-



ment of sufficient flexibility in organization structure to provide for any adaptations made necessary by changing policies. The ability to adjust the personnel and the organization to meet these changing policies is one of the most responsible

features of the personnel work.

The coordination of the employees to meet the functional program of a department vested with numerous duties can only be performed by a scientific approach to the question of personnel management and the selection and adjustment of the employees involved. As the functional work changes from time to time so must the personnel policies and procedures. To be successful, this must be based upon a greater understanding of the human resources available and upon adequate personnel research that will aim in directing the human effort along the lines formulated by the policy leaders of the organization.

IN-SERVICE TRAINING

During the year a survey was made of current training programs that included: Staff meetings held regularly for executives and supervisors for the discussion of problems of policy, administration, and supervision; seminars for scientists and technicians; annual and semiannual conferences of several days' duration for field staffs; intensive training programs lasting several weeks, usually for beginning professional employees and occasionally for other employees where the acquisition of new skills was necessary; promotional training given to employees selected for advancement; and general information about bureau functions given periodically to all employees of an office or project. These training programs are carried on by staff and line supervisors of the bureaus. Participation by the Office of Personnel has, for the most part, been limited to helping plan programs, prepare instruction manuals, select instructors and training officers, develop training techniques, and evaluate the results of training.

Plans have been formulated that will permit of an expansion along the lines of employee-training policy in Washington and in the field. Emphasis will be placed on training for supervisors of all grades in the broader aspects of Department policy and administration, on the preparation of selected employees for

promotion, and on special training for scientists and technicians.

In order to faellitate this activity the Office has encouraged the selection of more training officers by the bureaus and by their larger divisious and regional offices. These staff assistants will devote all of their time to placing and directing training programs. Additional steps are being taken to develop more accurate standards for measuring the effectiveness of in-service training.

accurate standards for measuring the effectiveness of in-service training.

The staff on training also made a survey of the Department's policies affecting personnel relations with universities and colleges. Arrangements were made for eolleges and universities to allow credit for certain types of research and investigation earried on in the Department. Several universities and colleges, in cities where the Department has numerous employees, offered evening eourses of value to employees, and several bureaus have appointed vocational advisers to help employees plan educational programs. The Office has participated in and will help to expand such post-entry educational opportunities for employees as a part of the general plan for increasing the efficiency of the Department's personnel.

SAFETY WORK

The year 1937 marked the beginning of an organized program of safety work for the Department as a phase of the general personnel management. The principal work of the safety staff has been to establish a uniform system of recording and reporting for the various bureaus, to develop cooperative plans for the use of safety machines in conjunction with the interdepartmental safety council and with representatives from each of the bureaus of the Department, and to conduct a general survey of positions involving hazardous lines of work and sources of potential injuries on the work projects of the Department. A survey of work projects in the field was started.

The widely diversified activities carried on by the 26 bureaus and offices of the Department range from the least hazardous, such as elerical office workers, to the most hazardous, such as quarrying, excavating, and lumbering. The most hazardous work is not confined to any one burean but to a number of them carrying on such work as drainage, road construction, soil conservation, flood



control, lumbering, forestry, and farm engineering. In practically all of these activities most of the accident hazards of both light and heavy construction work are found. The handling of heavy motorized machinery such as steam and power shovels, draglines, derricks, excavators, fresnos, tractors, trucks, and other equipment used for excavating, ditching, dam building, and shuilar work—together with the fact that much of this work is carried on in remote sections of the country where long-haul transportation and labor camps are necessary—all add to the hazards of such operations. Some of the greater hazards are found in the several hundred stone quarries operated by the various bureaus over the entire United States. The bureaus dealing with the harvesting and marketing of field and garden crops, fruits, and various products are exposed to peculiar health hazards as well as a number of industrial accident hazards during the inspection and transportation of these crops. In the chemical laboratories and in the field where research work is carried on by these organizations there are great health and accident hazards, particularly in the mixing, handling, and spreading of poisonous dusts for insect, parasite, and rodent control.

Chemical laboratories are not the worst hazard of the bureaus working to pre-

Chemical laboratories are not the worst hazard of the bureaus working to prevent diseases of our farm cattle. Handling all kinds of animals for inoculation, taking blood samples, etc., produces many injuries. Departmental workers occasionally become infected with the disease they are fighting, especially when coming in contact with hogs and beef or dairy eattle. Here again the hazards of industry are encountered in the inspection of meats and dairy products.

The safety staff has begun the coordination of accident-prevention programs carried on by the bureaus. This is reflected in a periodic accident report complying with the rules of the American Standards Association wherein all Federal accidents are carefully analyzed, causes ascertained, and future preventive methods suggested. In addition, bulletins and literature on accident prevention, fire prevention, sanitation, and health were widely distributed throughout the operating offices of the Department.

Field inspections were made in a number of bureaus, covering projects in some 15 States. This phase of the work will be materially developed in the coming year. The work of the staff also included representation at numerous meetings of safety, sanitation, and fire-prevention groups, at several of the national committees on accidents, etc., and the National Safety Congress at Kausas City. It also involved the participation in the radio program of the farm safety section.

The first periodic monthly accident report for the Department was published

in January 1938.

Table 1 shows a summary of the safety data accumulated to date.

Table 1.—Accidents to Department employees, January-June 1938

TABLE I.					
Month	A verage workers	Total time worked	Deaths	Disabling injuries	Frequency per million man-hours
January February March April May June	Number 175, 495 176, 307 186, 362 192, 093 206, 322 179, 206	Man-hours 28, 956, 983 26, 627, 644 32, 907, 915 31, 251, 866 33, 159, 259 30, 134, 042	Number 5 1 9 8 3 6	Number 763 590 620 476 546 554	26, 52 22, 19 19, 11 15, 49 16, 56 18, 58

APPOINTMENTS, SEPARATIONS, AND PROMOTIONS

Ou June 30, 1938, there were 68,431 employees serving under formal appointment by the Secretary of Agriculture as compared with 60,229 on June 30, 1937. This is partly accounted for by the placement of the field force of the Farm Security Administration, except project workers, under formal appointment by the Secretary of Agriculture on July 1, 1937. The gain is also brought about by the transfer of the land-utilization work of the Farm Security Administration to the Bureau of Agricultural Economics, increasing the force of the latter organization from 2,745 to 3,375, a gain of 630. There was also a galn in the Department rolls of 578 employees in the Soil Conservation Service and a loss of 659 in the Forest Service.



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There was a decrease in the number of employees in the Agricultural Adjustment Administration from 4,394 on June 30, 1937, to 3,001, a net decrease of

Table 2 reflects the appointments and separations in the Department of Agriculture for the last 5 years.

Table 2.—Personnel activities of the Department of Agriculture, 1934-38

	Employees	on rolls of D	epartment			Separations	
Year ended June 30	Depart- mental service	Field service	Total	Field stations	Employees appointed	from the Depart- ment	
1934. 1935. 1936. 1937.	10, 032 11, 437 11, 382 10 13, 371 11, 185	1 28, 591 4 32, 643 7 42, 140 H 46, 858 14 57, 246	38, 623 44, 080 53, 522 60, 229	1, 451 1, 864 1, 864 2, 924 2, 648	2 31, 434 5 29, 092 8 30, 634 12 34, 561 41, 677	3 19, 355 4 23, 635 4 21, 192 13 27, 854 33, 475	

- 1 Includes 80 in foreign service.
 2 Includes 11,667 in Agricultural Adjustment Administration.
 3 Includes 6,647 in Agricultural Adjustment Administration.
 4 Includes 52 in foreign service.
 5 Includes 8,249 in Agricultural Adjustment Administration.
 6 Includes 7,456 in Agricultural Adjustment Administration.
 7 Includes 52 in foreign service.
 6 Includes 5,186 in Agricultural Adjustment Administration.
 9 Includes 5,870 in Agricultural Adjustment Administration.
 10 Includes 2,329 in Resettlement Administration.
 11 Includes 88 in foreign service.
 12 Includes 1,336 in Agricultural Adjustment Administration.
 13 Includes 1,336 in Agricultural Adjustment Administration.
 14 Includes 103 in foreign service.
 15 Includes 11,091 in Farm Security Administration.

On June 30, 1938, there were 1,750 collaborators serving without compensation who are not included in table 2.

The turn-over of permanent employees during the year was 5.05 percent, as compared with 5.12 percent during the preceding year, 6.88 percent in 1936, and 7.19 percent during the year 1935.

The number of promotions both within the grade and from grade to grade was 17,639 during the year, as compared with 11,960 in 1937, and 10,815 in 1936.

RECORD OF LEAVE

Under the new leave acts of March 14, 1936, all employees were allowed annual leave at the rate of 26 days for the years 1936 and 1937. Annual leave accumulated since April 1, 1933, could be carried forward for taking in 1936. All employees were allowed sick leave of 1½ days per month, accumulative from January 1, 1936, with a provision permitting an advance of 30 days' sick leave beyond the accrued leave in eases of serious illness. Prior to January 1, 1936, employees in Washington were allowed 30 days' sick leave, while the field force were allowed with 15 days, neither being accumulative. only 15 days, neither being accumulative.

Table 3 shows the distribution of annual and sick leave used by employees in Washington in the calendar year 1936. The average annual leave taken by the men and women in Washington was 19.9 days as compared with 14.4 days in The average for employees in the field was 14.7 days as compared with

11.4 days in the previous year.

Employees in Washington used an average of 6.9 days sick leave in 1936, a rampioyees in Washington used an average of 6.9 days sick leave in 1936, a decrease of 1.9 days over 1935 and a decrease of 0.6 day over the average for the previous 8 consecutive years, which is the lowest average in any of these 8 years. There were 599 employees, or 5.7 percent, who used more than the 15 days sick leave earned during the calendar year. The total number of days taken by the 5.7 percent of the employees who used advanced sick leave was 15,609, or 21.5 percent of the total sick leave taken by all the employees.

In the field there was a slight increase in the amount of sick leave taken, the average being 2.9 days as compared with the 8-year average of the 2.8 days. There were 681 employees, or 2.7 percent of all the employees in the field, who

There were 681 employees, or 2.7 percent of all the employees in the field, who took advanced sick leave, the total amount of sick leave taken by them being 16,855 days, or 22 percent of the total leave taken.



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Table 3.—Distribution of employees in Washington according to number of days of annual and sick leave used, catendar year 1936

	Annua	I leave	Sick	leave		Annu	il leave	Sick I	Sick leave	
Days faken (number)	Enr- ploy- ees ¹	Total taken	Em- ploy- ees I	Total taken	Days taken (nnmber)	Em- ploy- ecs 1	Total taken	Em- ploy- ees !	Total taken	
	Num-		Num-			Num-		Num-		
· ·	ber	Days	ber	Days	1	ber	Days	ber	Days	
0	161	0	1,937	0	17	427	7, 259	34	578	
1	8.5	85	695	69%	18	443	7,974	49	882	
2	85	170	505	1, 610	19	447	8, 493	24	456	
3	71	213	616	1,938	20	530	10,600	36	720	
4	78	312	626	2, 501	21	534	11, 211	22	462	
5	108	540	60%	3,040	22	567	12, 474	30	660	
6	117	702	522	3, 132	23	540	12,420	37	851	
7	136	952	504	3, 528	21	592	11, 208	14	336	
8	177	1,416	485	3,550	25	677	16, 925	18	450	
9	151	1,359	461	4, 176	26	967	25, 142	15	390	
10	191	1,910	450	4, 500	27	415	12, 096	17	459	
11	209	2, 299	423	4, 653	25	346	9,688	10	280	
12	219	2,62%	615	7,776	29	214	6, 206	14	406	
13	278	3,354	315	4,521	30 and over 2	738	23, 206	228	7, 863	
14	312	4,368	337	4.715						
15	316	4,740	415	6, 270	Total	10, 518	208, 937	10, 518	72, 556	
16	374	5, 984	51	816						

 $^{^4}$ Not including employees serving a fractional part of the year, 4 30 and over for both annual and sick leave.

Table 4 gives the distribution of annual and sick leave taken by employees in Washington during the calendar year 1937. Men and women in Washington averaged 20.6 days annual leave in 1937 as compared with 19.9 days in 1936. The average for field employees was 18.4 as compared with 14.7 days in 1936.

Table 4. Distribution of employees in Washington according to number of days of annual and sick leave used, calendar year 1937

	Annua	il leave	Sick	leave		Annual leave		Sick leave	
Days taken (number	Em- ploy- ees 2	Total taken	Em- ploy- ees 2	Total taken	Days taken (unmber)	Em- ploy- ees ²	Total taken	Em- ploy- ees ²	Total taken
0,	Number 257 61 52 84 85 85 105 118 111 188 178 208 212 229 305	Days 0 64 104 252 340 440 630 826 991 1, 269 1, 958 2, 496 2, 756 3, 209	Number 2, 153 744 704 506 554 498 160 386 372 319 546 328 204 181	Days 0 741 1,408 1,788 2,216 2,490 2,760 2,760 2,976 2,871 3,160 3,608 3,576 2,652 2,531 2,293	17	359 393 441 483 509 513 600 396 320 265 1, 122	Days 4, 815 6, 732 7, 239 7, 180 8, 253 9, 702 11, 109 12, 216 13, 575 15, 600 10, 692 8, 960 7, 685 38, 935	Number 95 72 61 85 45 95 27 21 22 23 20 12 22 9	1, 615 1, 296 1, 159 1, 700 945 858 621 576 550 390 621 560 345 9, 104
15	305 317	4, 575 5, 072	135	2, 220 2, 160	Total	9, 195	189, 495	9, 195	60, 508

Average number of days annual leave, 20.6; average number of days sick leave, 6.6.

During the years 1936 and 1937 under the new sick leave act, the average sick leave taken by the men and women in Washington was less than in any year of the 8 previous consecutive years. The average sick leave used in 1936 was 6.9 days and in 1937 6.6 days as compared with an average of 7.5 days for the 8 preceding years. Due to the cumulative provision of the sick leave law greater protection is afforded the application of the sick leave law greater protection is afforded the application of the sick leave law greater protection is afforded the application of the sick leave law greater protection is afforded the application of the sick leave law greater protection is afforded the application of the sick leave law greater protection is afforded the application of the sick leave and it respectively. protection is afforded the employees against prolonged illness, and it seems that

Average number of days annual leave, 19.9; average number of days sick leave, 6.9.

Not including Farm Security Administration.
 Not including employees serving a fractional part of the year.
 30 and over.



There were 904 employees in Washington, or 9.8 percent, who used more than the 15 days' sick leave earned during the calendar year 1937. The total number of days taken by this group was 22,503, or 37.2 percent of the total sick leave taken

by all the employees.

In the field where the provisions of the slck leave act are the same as for the Washington employees, the average sick leave taken during 1937 was 3.6 days as compared with 2.9 days for the year 1936 and an 8-year average of 2.8 days. Eight and one-half percent of the employees in the field took 44,646 days and 91.5 percent used only 45,394 days.

During the calendar year 1937, 23 percent of the employees in Washington and 48 percent of the field force did not take any sick leave. The past 8-year average of employees taking no sick leave was 23 percent for the Washington employees and 52 percent for the field.

WORK INCIDENT TO APPOINTMENTS, TRANSFERS, AND PROMOTIONS

Changes affecting personnel in the Department required contacts with the Civil Service Commission and the procurement of authorities for appointment, transfer, reinstatement, promotions, etc., as indicated in table 5.

Table 5.—Personnel changes in the Department of Agriculture, 1934-38

Item	1934	1935	1936	1937	1938
Certificates from register Reinstatement certificates Certificates for change in status Transfer certificates Authorities for temporary appointments.	1, 510 481 254 465 4, 848	1, 648 416 910 220 740	1, 948 481 1, 388 152 771	1, 425 442 2, 166 287 4, 700	3, 696 366 2, 919 442 3, 278
Authorities for extensions of temporary appointments Authorities for extensions of suspensions Civil-service examinations requested	4, 031 3 29	1, 166 1 2 110) 270 3 124	941 7 65	979 0

¹ The material reduction in this item under previous years may be accounted for by the fact that the various bureaus and offices of the Department have been filling more or less temporary vacancies by probationary, for duration of work, appointments in which cases no extensions of temporary appointments are involved.

In continuation of the announced policy of filling vacancies by promotion, 271 vacancies were-published on bulletin boards for filling jobs in Washington, D. C. The applications received from these postings and the applications received from postings in the previous year were certified to the various bureaus and offices for consideration when vacancies occurred.

Table 6 gives information on how permanent vacancies in Washington, D. C., were filled during the year.

Table 6.—Permanent vacancies in Washington filled from July 1, 1937, to June

Year and month			Transfer or pro- motion from other bureaus		Recruitment outside Department		Total vacancies filled	
July	150 120	Percent 651/2 60 58		Percent 17 20 19	Number 28 39 40	Percent 1732 20 23	Number 160 198 175	Percent 100 100 100
October November December	106	58 5734 54	16	9 1334 13	62	33 29 33	184 200 189	100 100 100
January. February. March	83 76 77	55 49 55•	12 23 16	8 15 11	55 56 47	37 36 34	150 155 110	100 100 100
April May June	95	58 60 61	25 10 32	15 7 17	44 44 42	27 33 22	164 133 193	100 100 100
Total	1, 179	58	284	14	578	28	2, 041	100



In January 1938, the Office began work on installing a statistical punch card for personnel. This job was completed before the end of the year for the entire personnel of the Department. In addition a punch card for recording leave was devised and punched for all employees of the Department who were granted leave. A personnel questionnaire was devised and submitted to all employees in order to bring their qualifications up to date on the records of the Department. A qualification punch card was developed and in the next fiscal year the questionnaires will be coded and cards punched.

Much credit is due the bureaus and offices of the Department which provided

funds to pay salaries of employees engaged on this work,

During the year 117,040 personnel actions were handled as compared to
98,635 personnel actions for the previous fiscal year.

RETIREMENT RECORDS

During the year 378 applications for service credit, 1,690 applications for refund of retirement deductions, and 4,009 master retirement record cards were completed, audited, and certified.

Retirements from the service and amnities of those retired are shown in

tables 7 and 8.

Table 7.—Number of employees retired, 1934-38

	Annu	ity retirer	nents in clas	1	osability 1	etirements	in class c		
Year ended June 30	Profes- sional	Subpro- fessional	Clerical, adminis- trative, and fiscal	Custo- dial	Profes- sional	Subpro- fessional	Clerical, adminis- trative, and fiscal	Custo- dial	Cases dis- posed of
1934 1935 1936, 1937 1938.	51 46 29 35 38	63 65 50 42 45	58 24 18 18 18	24 12 6 5 12	12 10 11 8 11	12 14 19 20 15	28 29 18 20 27	11 5 3 5 1	259 205 154 153 170

Table 8.—Averages of the annuities in the various groups, 1934–38

Group	1934	1935	1936	1937	1938
Professional and scientific Subprofessional Clerical, administrative, and fiscal Custodial	\$1, 102, 22 946, 81 946, 83 757, 72	\$1, 039, 81 960, 08 826, 35 728, 50	\$1, 068 59 990, 43 865, 08 654, 05		\$1, 150, 35 1, 068, 48 901, 68 902, 35

The minimum annuity granted was \$158.88. The largest straight life annuity was \$1,335.72, and the largest increased annuity with forfeiture was \$1,351.68. Eight of the optional retirements occurred in the 70-year, six in the 62-year, and two in the 65-year age group. It is interesting to note that no females took advantage of their optional retirement rights during the past 2 years.

Under the law, exemptions from compulsory retirement must be approved by

the President. Extensions in the service upon reaching retirement age have been granted to only 19 employees since July 1, 1932. Some of these employees, however, were granted more than one extension.

During the year continuance in the service beyond retirement age was granted to a principal chemist, Office of Experiment Stations; a principal horticulturist, a senior pathologist, and a principal pathologist, Bureau of Plant Industry; an associate petrographer, Bureau of Public Roads; a principal agronomist, Soil Conservation Service; a senior attorney and a regional law officer, Office of the Solicitor.

CLASSIFICATION OF POSITIONS

The classification of positions under the Classification Act of 1923, as amended, involved an intensive review of positions in the emergency phases of



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A total of 6.799 appointments and changes in status in Washington employees were acted upon during the year. The number recorded is slightly greater than the preceding year because of the establishment of new operating units in the Department of a result of Course of the stablishment of new operating units in the

Department as a result of acts of Congress.

The consolidation of land-utilization units of the Farm Security Administration with the Burean of Agricultural Economics and the creation of the Federal Crop Insurance Corporation and the Federal Surplus Commodities Corporation have contributed towards this increase. Many cases are actually reviewed and returned without action. The advice and service rendered in such cases is not reflected in the total number of actions that pass through the Office for final consideration at the Civil Service Commission or by the Director of Personnel. Each case, whether it bivolves a change in duties or an appeal for reallocation, involves careful job analysis and comparison with similar positions throughout the Department. The purpose of this work is to equalize the responsibility of class assignments so that the principle of classification may be maintained with resulting equal pay for equal work.

There has been a marked decrease in the number of appeals handled over the year preceding as more attention was given to the individual and group job adjustments of employees. A summary of this activity insofar as it relates to the personnel in Washington for the past 5 years is given in table 9.

Table 9.—Appointments and changes in status of employees of the Department of Agriculture, 1937—38

Year ended June 30	Appoint- ments to new posi- tions	Changes in duties	Changes to vacancies	Appeals	Total
1934	5, 561	1, 274	.2, 329	15	9, 179
1935	1, 634	3, 315	3, 260	45	5, 254
1936	1, 905	3, 698	2, 145	45	7, 793
1937	911	4, 002	1, 403	23	6, 339
1938	1, 417	3, 921	1, 451	10	6, 799

In addition to those shown in table 9 a number of positions have been reviewed from the tield service and classifications assigned according to departmental standards. The volume of such fransactions has remained somewhat constant over the year and does not represent any unusual changes in the Department. As the reorganization of the larger field offices has been completed, the field personnel has reached a normal level. Material assistance has been rendered to the field service in various reorganization studies and in general advice on the classification and the proper alignment of positions. These organization studies help to establish Department standards, clarify lines of burean responsibility, and set down division and section responsibilities and authority which results in greater operating efficiency for the whole.

which results in greater operating efficiency for the whole.

A survey was made of the various positions connected with the Forest Service headquarters in Milwankee. A comprehensive management and classification study was prepared on the Commodity Exchange Administration, including the Washington, Chicago, and New York offices and personnel. In addition cross-section studies on grade levels, duty series for several types of work, and other occupational studies were continued. An extensive survey was made in con-



junction with the Civil Service Commission on all audit and accounting positions in the Department. This was conducted partly through a direct audit and partly through a questionnaire method. In addition a field-inspection survey was made, which included an analysis of work in four of the large bureaus of the Department which maintained decentralized fiscal offices. Approximately 40 tiscal headquarters throughout the country were visited. The information secured was carefully analyzed along with various bureau procedures and practices. The report has served and will continue to serve for a more effective ovaluation of fiscal operations and will-provide for a more equitable classificaevaluation of fiscal operations and will-provide for a more equitable classification of the positions in this field of activity. These inspections provide information that help to evaluate the work performed and aid the classification staff to interpret and equalize the work activities of the Department over a large area. They serve to encourage the employees and remove many of the mental and physical obstacles which confront those who work at a distance from the headquarters and who remain somewhat unfamiliar with the details and procedures that are involved in the reallocation of positions.

Members of the staff have represented the service at the Civil Service Assembly and in other organizations concerned with classification. Active participation in these organizations enables the Office to secure a wider range of information and helps to spread desirable facts on the procedures involved and at the same time creates a better nuderstanding among the employees. The trained assistants have rendered material help to the Department in improving the general attitude towards classification and in informing employees as to the the general attitude towards classification and in informing employees as to the requirements of duty assignments, as to the evaluation of responsibility, as to the interpretation of job descriptions and job levels and related problems of organization that are presented either informally or officially to the Office. The surveys of this nature help to clear many of the intangible problems of the surveys of this nature help to clear many of the meangible problems of classification, facilitate administration, and improve the employee attitude towards the service. The work helps in maintaining a just and uniform standard of work and pay for similar rates of performance throughout the many agencies of the Department.

INVESTIGATIONS

During the year 71 personnel, 6 Civilian Conservation Corps camps, and 31 miscellaneous investigations were conducted by the Division of Investigations. In addition, 880 Agricultural Adjustment Administration contracts were in-In addition, 880 Agricultural Adjustment Administration contracts were in-vestigated to discover (1) whether the payees received the payments to which they were entitled, (2) erroneous payments, and (3) forgeries of payment checks. Because of the Division's findings, a substantial amount of money was recovered for the Government, and final settlement of these cases will result in the growthal regaint by the previous of the propay to which they are might be in the eventual receipt by the payces of the money to which they are rightfully

A total of \$95 cases, most of which were for the imposition of disciplinary penalties on account of delinquency, misconduct, and fiscal and other irregularities on the part of employees, received consideration by the Division of

Because of the large number of special investigations and the limited number of investigators, no pregress was made with the contemplated periodical investigation of field stations and offices. Since additional investigators are now available, however, it is hoped that considerable progress with this phase of the Davision's work will be possible during the coming year. tuvestigations.

The year's work resulted in 1,044 separate personnel actions, as follows:



ANNUAL REPORTS OF DEPARTMENT OF AGRICULTURE, 1938

Appointment terminated with prejudiceResignation accepted with prejudice	. 76 57
Action taken for other than disciplinary reasons	550
Appointment terminated without prejudice Resignation accepted without prejudice Other	. 173
Total	. 1, 044

EMPLOYEE ACTIVITIES

The employee organizations through the Welfare Association and the Athletic The employee organizations through the welfare Association and the Athletic Recreational Association have continued to sponsor numerous activities in the development of educational, recreational, and athletic facilities for the various groups of workers. They have made possible additional weltare improvements. They have contributed materially to improving the acquaintanceship between employees and in developing self-expression and participation in extracurricula activities, which now constitute an important place in the social life of the Department. the Department.

The regular Welfare Association publication was not issued during the year but the Athletic Recreational Association has published a very complete hand-book showing the types of work which it sponsors and the various officers connected with it. Among the interests sponsored are baseball, basketball, bowling, dramatics, camera craft, swimming, golf, hiking, horseback riding, skating, softball, trips, and other activities. These activities have received the general interest and support of the departmental employees.



Stockberger, W.W.

S. Department of Agril ultule

LIBRARY

SOME PHASES OF THE PERSONNEL PROBLEM IN THE U. S. DEPARTHENT OF AGRICULTURE

by Dr. W. W. Stockberger, Director of Personnel and Business Administration.

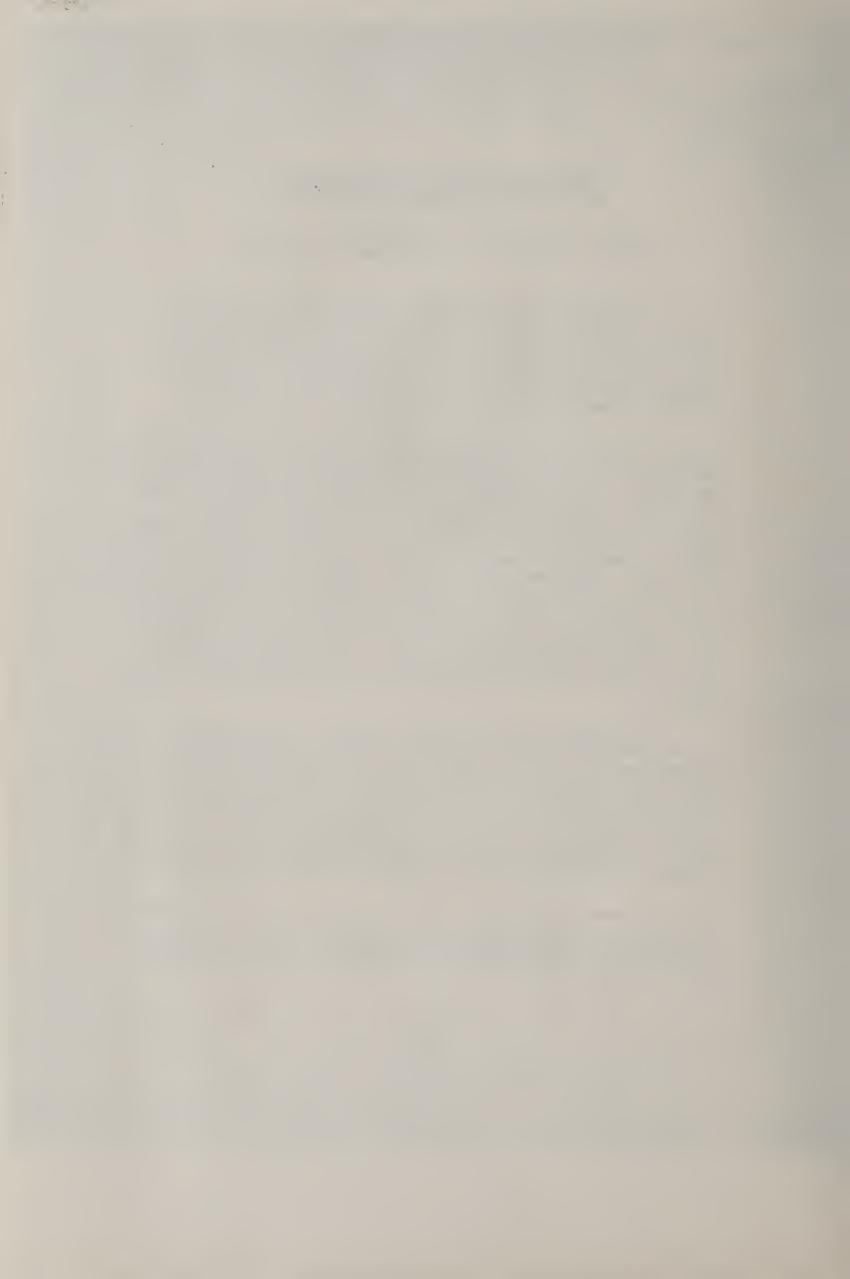
The Department of Agriculture, created by The Congress in 1862, was provided in that year with an appropriation of \$64,000 and directed to acquire and diffuse useful information on subjects connected with agriculture in the most general and comprehensive sense. Year by year the scope of the Department's activities has extended beyond the work of collecting and issuing agricultural information until now it covers a very broad and complex field.

The work of the Department touches every phase of agriculture as woll as many related problems. "This work deals with the selection and breeding of superior plants, the development of new varieties, and the biology of plant diseases. It studies how to increase the weight of the beef animal, and the milk production of the dairy cow. It ascertains facts about the nutritive value of feeds. It investigates problems of soil composition and fertilizer requirements. It develops poisons, insecticides, and serums for use in the war against pests and parasites. It goes into the economic problems of the farmer, into his social and community problems, into his transportation problems, into his problems as a consumer. It studies wild life, so that beneficial species may be protected and conserved or reared under domestication, and harmful species controlled. It deals with engineering problems, such as those connected with irrigation, with the prevention of soil erosion, with highway construction, and with the efficient use of farm machinery.

"It embraces also problems of importance to the home maker, such as those connected with diet, cocking, clothing, house equipment, and the expenditure of the family income. It carries an work in industrial chemistry, to promote an increased utilization of farm products and farm by-products. It inquires into the purity and healthfulness of food and drugs offered for sale in interstate commerce. It studies the weather, for the protection of a thousand agricultural and industrial interests. All the main branches of science, particularly chemistry, biology, and physics, are represented in the department's research activities."

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^{1.} Eisenhower, M.S. and A.P. Chew. The United States Department of Agriculture, Its Growth Structure and Functions. U.S.D.A., Misc. Pub. No. 88. 1930. p.9.



Prior to the creation of the Department of Agriculture a small staff in the Patent Office was engaged in such work in agriculture as was then sponsored by the Federal Government. The subsequent growth of the Department as reflected by the increase in personnel is shown in the following statement:

Year	Number of Employees
1861	9
1871	84
1881	104
1891	1,577
1901	3,388
1911	12,704
1931	18,748
1931	27,615

It is said that in 1866 the entire scientific staff of the Department comprised only ten individuals. In 1931 the number of professional positions in the Department, following the terminology of the Classification Act of 1923, was 5346. The distribution of these positions by salary groups is given in Table No. 1.

The Department is composed of 20 principal administrative units designated Bureaus or Offices. The number of professional positions in these units varies widely due in part to variation in size and in part to differences in the nature of the activity with which an individual bureau or office is concerned. The distribution of professional positions by bureaus and salary group appears in Table No. 2.

The professional positions in the Department may be divided roughly into six occupational groups. The distribution of these groups by bureaus is shown in Table No. 3. It will be noted that the largest number of positions, 3054, falls within the agricultural, biological and physical science group, and the second largest number, 1330, in the veterinary science group. The medical science group has the smallest number of positions.

The positions dealt with in this paper occur under general class titles. For convenience in tabulating the data, the term class is here used to include all positions having the same generic designation, as chemist, agronomist, entomologist. If, in Table No. 4, the grade designations junior, assistant, etc. are substituted for the symbols P-1, P-2, etc. there will become evident the individual classes in the sense in which this term is used by the U. S. Personnel Classification Board. Inspection of Table No. 4 reveals that certain classes contain a much



larger number of positions than others. The twenty classes of highest rank numerically contain 4343 positions or 81.2 per cont of the total number. Consider now the distribution by bureaus of the positions in these twenty principal classes. From Table No. 5 it appears that with the exception of chemists no one of these twenty classes is represented in more than five bureaus and again with the exception of chemists a large proportion and in seven cases all of the positions in each class is is restricted to a single bureau. This is a normal result of the specialized activities of the several bureaus and accounts for the small number of professional employees who transfer from one bureau to another.

The question is often raised as to the value of a higher academic degree as a factor in the advancement of employees to positions of greater responsibility and emolument. So many factors condition such advancement that conclusions as to the influence of a degree in the attainment of a position of higher rank may be of very doubtful value. However the study of the professional employees of the Department set forth in Table No. 6, will afford material for some speculation on this problem. Considering the 201 employees in grade P-6, it will be observed that 23 or 11.4 per cent have the degree D.Sc., D.Agri., etc.; 53 or 26.3 per cent have the degree Ph.D.; 43 or 21.3 per cent have a master's degree; 61 or 30.2 per cent have a bachelor's degree, and 13 or 6.4 per cent have no academic degree. It should be stated that in case an employee has both the degree Th.D., and the degree D.Sc., D.Agr., etc. the latter were disregarded in this tabulation. On the whole the ovidence from the table is favorable to the view that a higher degree is a distinct factor in advancement.

Among the several bureaus of the Department there is a wide variation in the degree status of the employees in those units. For example, in one bureau the number of employees with no academic dogree is 0.3 per cent of the total and in another bureau 77.8 per cont. The complete data for all bureaus is given in Table No. 7. There is a three-fold reason for the occurrence in the professional service of the relatively large number of employees with no academic degree. (1) When the Classification Act of 1923 became effective the Personnel Classification Board arbitrarily placed in the professional service certain existing classes of positions for which an academic degree had not been previously considered as a prerequisite. This in effect blanketed into the professional service a substantial number of employees who had no academic degree. (2) Certain positions which have been placed in the professional service sometimes are filled without requiring college graduation as a qualification. (3) In the case of the Weather Bureau no college at present affords the special training in meteorology which is necessary to the work of this bureau. Young employees, without college training, who have entered the service in minor positions are advanced to positions in the professional service as soon as they have acquired by actual experience the knowledge necessary to perform the duties required.

The ages of the professional employees in the Department range from 21 to 75 years. In table No. 8 it is seen that beyond 30 years, age appears to be a factor of little importance in an employee's advancement to successively higher salary groups. Of the total number of employees, 4049 or 75.5 per cent are found between the ages 25 and 50 years inclusive, and 1161 or 21.2 per cent are above the age of 50 years. The distribution by age groups is as follows:

21	to	30	years	957
31	to	40	, - M -	1679
41	to	59	Ħ	1574
51	to	60	11	841
61	to	70	n	272
71	to	75	ti	23
Total				5346

As may be expected the distribution by years of service, as seen in Tablo No. 9, does not follow closely the distribution by age. This tablo also shows that after the 25th year of service there begins a sharp roduction in the total number of employees. Now, by far the largest number of appointments are made in the Junior and Assistant grades, F-1 and F-2 respectively, and the approximate age of appointees is about 25 years. At the end of 25 years of service these employees would have attained the age of approximately 50 years. The suggestion has been made that the decline in the number of employees at about their fiftieth year is directly related to the decline in number after 25 years service, but such a conclusion could be accepted only after verification based upon a study of the appointees in each of the preceding 24 years.

The nositions in the salary group \$5600 to \$6400 are for the most part occupied by the heads of important bureau subdivisions. They represent posts of large responsibility and are filled by promotion from the next lower salary group if individuals of suitable fitness are available, otherwise selection is made through civil service examination. It has been of interest to determine the institutions from which this group received their most advanced degrees as a possible indication of the source from which the most desirable applicants have been secured in the past. The distribution of the employees in this group by institutions appears in Table No. 10.

The distribution of agricultural oconomists, agronomists, chemists, plant pathologists and entomologists by salary groups and institutions which conferred upon them their first academic degree is shown in tables 11, 12, 13, 14 and 15 respectively. It appears that 139 agricultural economists represent 59 colleges and universities, 138 agronomists represent 42 institutions, 405 chemists represent 186 institutions, 168 plant pathologists represent 63 institutions and 341 entomologists represent 80 different institutions. The largest number from any one institution



is; agricultural economists, 21 from the A. & M. Cellege of Texas; agronomists, 28 from Kansas State Agricultural College; chemists, 26 from George Washington University; plant pathologists, 11 from the University of Kinnesota and the University of Nebraska respectively; and entomologists. 48 from Massachusetts Agricultural Cellege.

The limitations of this paper do not permit an extended discussion of the advantages and disadvantages of a career in the public service. Moreover this is a topic concerning which epinion is far from unanimous. The most authoritative statements on this subject with especial reference to government employment conditions as compared with those of outside industry appear in a series of remarkable reports issued by the U.S. Personnel Classification Board 1 from

1. Personnel Classification Board, Report of Wage and Personnel Survey, 70th Cong., 2d sess., H.Doc. No. 602 (Washington, Government Printing Office, 1929) 511 pp. Fersonnel Classification Board, closing Report of Wage and Personnel Survey (Washington, Government Printing Office, 1931) 404 pp. Feldman, H., A.Personnel Program for the Federal Civil Service, A Report Transmitted by the Director of the Personnel Classification Board, 71st Cong., 3d sess., H.Doc. No. 773 (Washington, Government Printing Office, 1931) 289 pp.

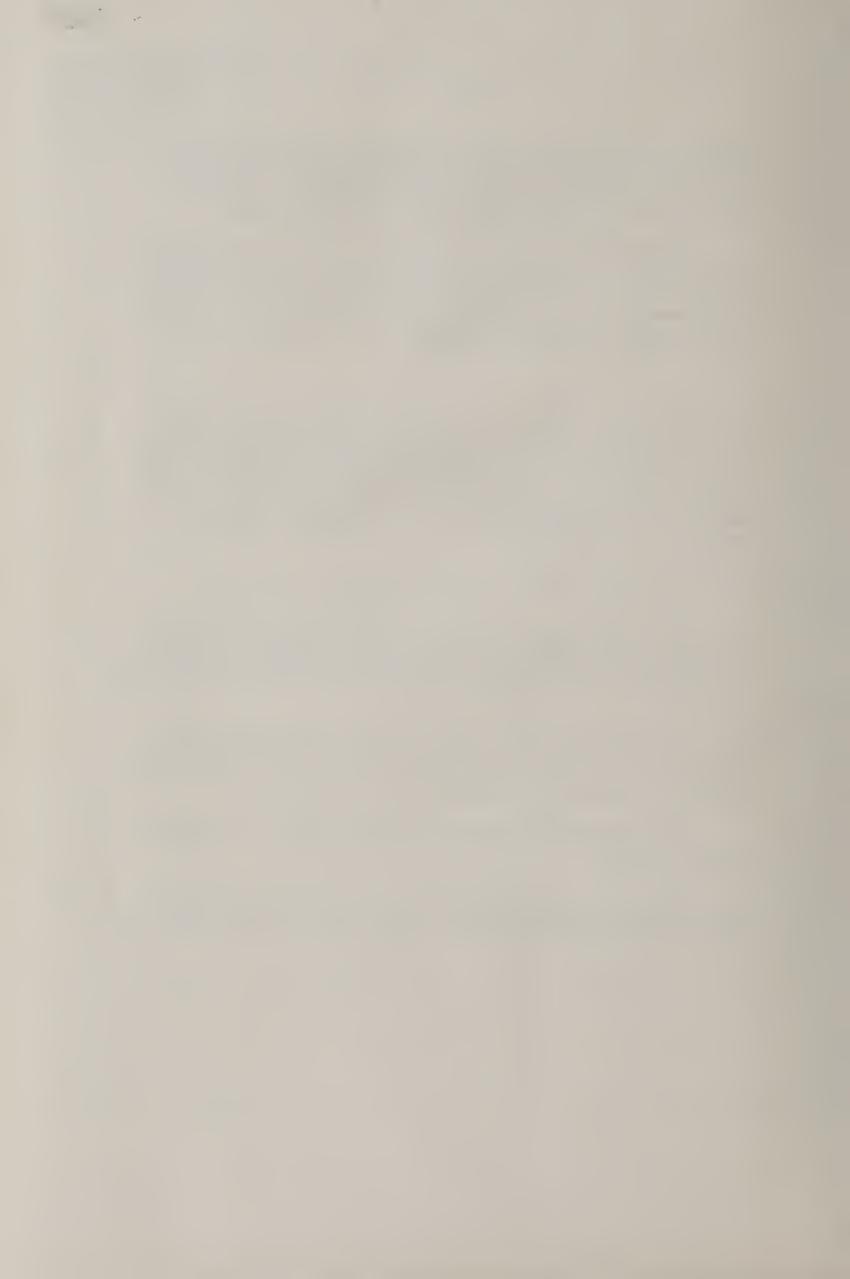
which the following "findings" are quoted from the second report:

"The Government pay scale for positions in the professional and scientific service compares favorably with the average pay for similar non-Government pagitions below the \$3800 level, but above the \$3800 level the Government may scale is lower and the discrepancy becomes greater as the importance of the work increases." p. 119.

"For professional and scientific positions the Government salary scale is generally more liberal than the average salaries for similar positions in the larger colleges and universities (not including extracurricular income), although these same positions command a considerably higher rate in some of the institutions in question." p. 120.

"The salaries maid by private concerns to their major executives exceed those paid by the Federal Government any where from 100 to 500 per cent." p. 122.

"The hours of work in the Federal service compare favorably with those in general commercial practice, except that the practice of not working Saturday afternoons is more prevalent in private industry." 1p.126



1. Since this was written tho 71st Congress has passed a law, approved March 3, 1931, providing that four hours shall constitute a working day on Saturday throughout the year, for all civil employees of the Federal Government and the District of Columbia, exclusive of employees of the Postal Service, the Panama Canal on the Isthmus, and the Interior Department in the field. (Pub. 783, 71st Cong.)

"The leave privileges in the Federal service are generally more liberal than those in prevate employment." p. 127.

"Non-Government employers do not generally provide retirement systems, but in some cases systems even more liberal than the Federal retirement plan are provided, such as group insurance and cooperative stock purchasing plans." p. 127.

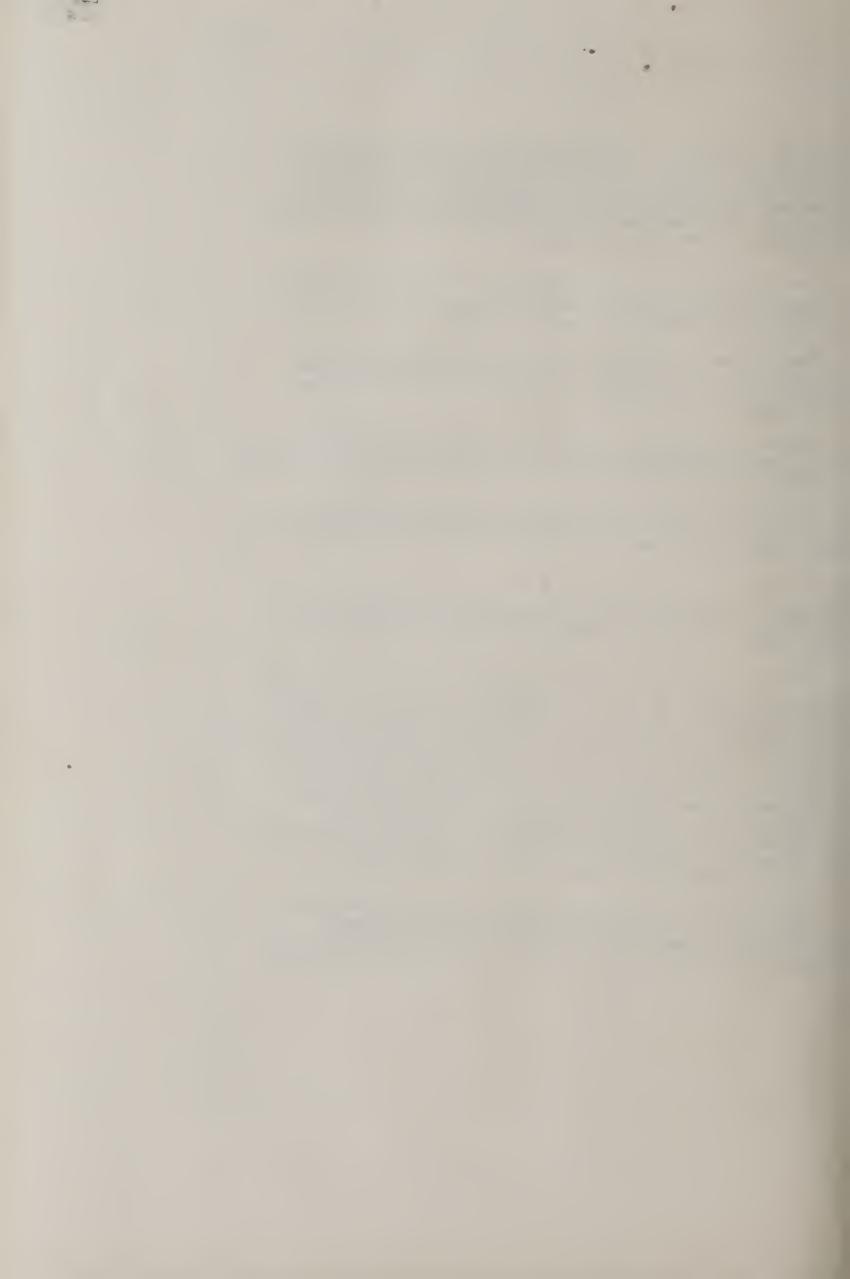
"The civil service requirements for employment in the Federal service are more exacting and thorough than entrance requirements generally for non-Government employment." p. 128.

Of all the published specifications for different classes of positions, those of positions in the Federal field service, issued by the Personnel Classification Board I. in 1930, are beyond doubt the most

1. Fersonnel Classification Board, Preliminary Class Specifications of Positions in the Field Service (Washington, Government Printing Office, 1930) pp. 1327.

complete and definite. But this completeness in itself may prove to be a serious disadvantage in the work of allocating field positions to the ampropriate grade. Aside from personnel officers, probably few employees have either the time or the inclination to master the fundamental principles of classification, and the voluminous detail of these class specifications. Far too many employees, including some administrative officers, have the impression that the class specifications afford a convenient mechanism for socuring increases; in compensation and apparently entirely disregard the fact that the purpose of classification is not to increase salaries but to establish a reliable and systematic grouping of commarable positions and to equalize rates of pay.

Although the writers of these specifications made commendable efforts to establish an unmistakable line of domarcation between successive grades in each series, they were not wholly successful, since the distinction between grades is based upon differences in importance.



Unfortunately these characteristics do not obligingly become discontinuous at the points arbitrarily fixed in the compensation schedule as the dividing line between grades with the result that honest and sometimes disengenious differences of opinion arise between employee and supervisor or between supervisor and personnel officer as to the proper allocation of a given position. The foregoing statements are not to be construed as a criticism of the specifications in question, but as an illustration of a difficulty which is certain to arise in their application unless there can be developed in each administrative unit a group of employees trained in the technique of personnel management to insure uniformity of ampraisal of the duties and responsibilities involved in each position.

Although the specifications promulgated by the Personnel Classifi; cation Board provide an indispensable working tool in personnel administ tration, they are not the most satisfactory guide to university training for the Federal service, a purpose however for which they were not intended. The work which the American Council on Education has undertaken in this field promises to yield results of primary importance to those concerned with the training of university students. As a part of their general program, representatives of the Council enlisted the aid of officials of the Department of Agriculture in securing definite information regarding the requirements of various pursuits in the professional service. This information has been resolved into a series of "Criteria of Successful Achievement" for various pursuits, such as chemist or botanist, in which is presented for the whole body of workers in a given oursuit a composite of their activities and the manner of their performance of them. Aside from their prospective usefulness as a guide in the training of students, these Criteria serve to give employees a better understanding of the objectives for which they should strive in their work. Commenting thereon one chief of bureau said, "These Criteria have given the men in my bureau a better idea of the training and experience necessary to fill a given job, and has impressed upon them the fact that they had never before fully appreciated the scope and importance of their positions", and another, "We have found these Criteria helpful in securing a desirable kind of examination, and as an aid in visualizing the kind of men needed to fill our positions." It is sincerely to be hoped that these important studies of the Council may be carried forward to early completion.

The scientific personnel of the Department of Agriculture is recruited through open competitive civil service examinations which may by other assembled or unassembled. In the assembled examination applicants are rated according to the correctness of their response to a set list of questions relative to the subject of the examination and on a thesis submitted on the day of examination. Sometimes the applicant is rated on education, training and experience also. In the unassembled type of examination applicants are usually rated (1) on education, training, and experience, and (2) on publications or a thesis.



For admission to an examination of the Junior grade there is a general preliminary requirement of applicants to show that they have been graduated with a degree from a college or university of recognized standing with the completion of at least 118 semester credit hours. Applicants for admission to examinations above the Junior grade must show that they have the requirements of that grade and in addition:

- (1) In the Assistant grade, two years successful experience or two years post-graduate study in the general subject of the examination.
- (2) In the Associate grade, three years successful experience or three years post-graduate study in the general subject of the examination.
- (3) In the Full Professional grade, experience and post-graduate study totaling at least five years.
- (4) In the Senior grade, experience and post-graduate study totaling at least six years.
- (5) In the Frincipal grade, experience and post-graduate study totaling 8 to 10 years

These are typical requirements and are frequently modified to meet special conditions or needs.

When a position of unusual importance is to be filled the usual form of civil service examination may not be used but instead the qualifications of candidates are passed upon by a special board of examiners composed of representatives of the United States Civil Service Commission and of representatives from other organizations, who are eminently qualified in the general subject of the examination. The kind of qualifications required for an examination of this type are shown by the following exerpt from an examination for Senior Toxicologist held November 30, 1930:

"QUALIFICATIONS - The examination will consist solely of the consideration of qualifications by this special board. The minimum qualifications for consideration are education equivalent to that represented by an M.D. degree from a college or university of recognized standing with major work in toxicology, pharmacology, zoology, physiological chemistry, or a closely related branch of science, and experience in important research or experimental work in pharmacology or toxicology, or both, of sufficient length and character to demonstrate keen judgment and perception of the scientific problems fundamental to the duties of the position. The appointee must possess executive ability and be free from personal traits



and interests that night interfere with the smooth operation of the division. This position is of a highly specialized character and of great importance, and it is desired to secure the services of a person who has has broad training and wide experience in texicology or pharmacology, or both, and in the supporting branches of science, and who is well qualified to initiate research and handle work of cooperative and supervisory character. With these ends in view considerable weight will be given to the applicant's general reputation and to the opinions of persons qualified to vouch for the applicant's general reputation and attainments."

The number and title of the examinations held in 1930 from which appointments were made by the U. S. Department of Agriculture are shown in Tabbe No. 16. The number of appointoos, by salary groups, from these examinations is likewise shown. Of the 129 examinations held, 44 were assembled and 85 unassembled. In two of the latter cases the qualifications of candidates were passed upon by a special board of examiners.

We believe that courses pursued by students in preparation for appointment in the Federal sorvice could be advantageously modified in certain respects. An outstanding and often well merited criticism of many college graduates who enter the service is that they are poor in English composition and are therefore unable to present the results of their work in a form either suitable for publication or creditable to themselves and the organization which they serve. If a modicum of the time now devoted to the training of students to undertake research work were devoted to training in the art of presenting in suitable form the results of investigations, a marked improvement in the clearness and intelligibility of the writings of students so trained would certainly become evident.

Timo was when extent of factual knowledge was the tost of an educated man, but during recent decades factual information has so increased that now no man can be master of even a narrowly specialized field. Knowledge of the sources of information and how to use them is now indispensable. It is submitted that training in the art of acquiring such knowledge should be incorporated in the courses pursued by students preparing for Federal employment.

Every entrant into the Federal professional service must be regarded as a potential supervisor of assistants or in addition as a potential administrator. A prominent factor in an employee's advancement is his ability to win the comperation of his subordinates and to weld them into a loyal and effective working unit. The individual who is "temperamental", who rules his subordinates with an iron hand and is inconsiderate of their rights as follow human beings, impairs his



chances of advancement in addition to developing in his group a spirit of dissatisfaction and resentment which is incompatible with good service. Since this matter of human relations is one of importance to the individual, whether in or out of the Foderal service, it is suggested that provision be made in appropriate courses for at least same training in this particular field.

Lack of knowledge concerning the purpose, functions, organization and operation of the several branches of the Federal government characterizes many of the entrants into the service. Due to this lack the newcomer, particularly if just graduated from college, requires a certain period in which to adjust himself to his new surroundings and to acquire some familiarity with that orderly and systematic procedure in the conduct of government business, popularly referred to as "red tape". The period of adjustment is often an unproductive one during which the employee may become discouraged or dissatisfied. It is also a period of trial for the employee's supervisor who perforce must act as instructor in the elementary principles of governmental organization and procedure. Moreover the admancement of an employee to positions of greater responsibility is seriously impeded if he fails to visualize himself as an integral part of the organization as a whole, and, as sometimes happons, develops an antagonistic attitude toward organized and orderly procedure. It is probable that the orientation period of the new employee would be less painful and prolonged if before graduation he had pursued a course in the principles of public administration, or in the principles of Foderal administration. It is thorefore recommended to this Conference that align be taken in favor of the ostablishment of such courses generally. Students who pursuo such courses may or may not enter the Federal service but in either event they will be able more intelligently to meet the requirements of citizenship.



Table No. 1. - Number of Professional Positions in Each Grade and Salary Group, Departmental and Field Services

Grade	: Salary Group :	Departmental :	Field	Total
Junior, P-1	: : \$2000 - 2600 :	164 :	1099	1263
Assistant, P-2	2600 - 3200 :	225	1612	1837
Associate, P-3	3200 - 3800	289	693	982
Full Grade, P-4	3800 - 4600 :	123	247	370
Senior, P-5	: 4600 - 5400 :	294	365	659
Principal, P-6	5600 - 6400	128	75	203
Head, P-7	: 6500 - 7500 :	13	2	: 15
Chief, P-8	8000 - 9000	14	3	17
Total	1 :	1250	4096	5346



TablerNo. 2. - Number of Professional Positions, by Bureaus, in Each Classification Grade, Departmental and Field Services.

		-	Departmental	menta		Service					Fi	old Se	Field Service				Total
pareau	P-1	P-2	P-3 F	P-4 F	P-5 F	P-6 P-	2	P-8	P-1	P-2	P-3	P-4	P-5 P	2-6 P	2	P-8	
Agricultural Econ.		- eH	36	19		o	2	-	26	18	30	16	22	∞ ⊣ r			276 81
Animal Industry	م م	200	13	11 2	32	01 4	Н	HH	266	21	133	7.7	00 4	-1			100
Chemistry & Soils Dairy Industry	63	72	15	22	31	13	н -		92	12 10 10 103	14 4 68	0 0 E	4 6 6	N			303
Entomology Experiment Stations	~ N	4 0	22	3 10	76) Ю	1	1	0	(i)	က	2	4	Ω			43
Extension Service Food & Drug Admin.	12	111	15	141 3	27	ω ω 4	H	H	81	72,	325	31	8 55 33	200	8	ю	302 469 8
Grain Futures Admin.						Н	H				-1	4	0	4			33
Home Economics	9	Ħ	ω	N H	44												4.1
Library Plant Industry	68	28 3	50 cs	20	45	38	Н	H	49	75	111	33	33	Ŋ			524
	_	20	~	~1	4	3	H		150	16	28	O	Ω.				311
Pit. Quar. & Acm. Public Roads	Q F	2 6	30	9	25	~ "	٢	r4 <	101	78	113	44 86 0	78	Ω.			528
Secretary's Office	N	ω	41	r-l	11	4 5	4	*	140	133	9	7	23	ß			398
neo ma Jaureau	164	225	289	123	294	128	13	14	1099	1612	693	247	365	75	N	8	5346



Table No. 3. - Number of Positions by Bureaus and Occupational Groups

Bureau	Lconomics	Agr., Biol.& Physical Sci	Medical Science	Veterinary Science	Legal Group	Library Group	Ingineering Group	Total
gricultural Economics	144	121				111		276
gricultural Engineering	1	201				1	79	81
nimal Industry		117		1323		1	1	1442
diological Survey		90		1			9	100
hemistry and Soils		285	1			1	16	303
Dairy Industry	1	71		1		1	2	76
intomology	,	362				1 3	1	363 43
Emeriment Stations	1	38				ی	1	40
Extension Service	7	35				1		43
Food and Drug Admin.		290	6	5		1	50	302
Forest Service	24	395					50	469 8
Frain Futures Admin.	6	6						0
Iome Ronomics	21	11				1		33
Information		4						4
Library	-	C3.4				16		16
Plant Industry	3	514				7		524
Plant Quar. & Cont. Adm.		309					2	311
Public Roads	9	15			40	1	477	502
Secretary's Office		4 707			48	1		52
Weath or Bureau		397	-			1		398
Total .	213	3054	7	1 330	48	47	637	5346



Table No. 4. - Number of Professional Positions by Classes and Grade or Salary Group

Class				Sal	ary G	roun			
	<u>P-1</u>	P-2	P -3	P-4	P-5		P-7	P-8	Total
Agricultural Attache						3			0
Agricultural Chemist			1			3			3
Agricultural Commissioner			î	2	2	4			1 9
Agricultural Economist	19	36	33	16	28	8	2	1	143
Adricultural Editor					1		~		1
Agricultural Engineer	8	6	9	10	4		1		38
Agric. Extension Economist					1				1
Agricultural Statistician	2	1	6	7	14	2			32
Agricultural Technologist				1					1
Agric. Transportation Econ.					1				1
Agricultural Writer				1	2	1	1		5
Agriculturist			2		15	8			25
Agronomist	16	29	60	10	18	12			145
Animal Fiber Technologist	1								1
Animal Husbandman	3	7	14	4	9	1			38
Apicul turi st		4	5	1	1				11
Architect		1			1				2
Architectural Engineer		1			1				2
Attorney		4	14	2	11	4			35
Automotive Engineer		1							1
Bacteri ol ogist	7	6	10	2	8	1			34
Bibliographical Assistant	1								1
Bibliographical Intomologist		1							1
Bi och emi st	1	6	9	3	13	2			34
Biological Chemist				1					1
Biological Editor				1					1
Biologist	25	20	13	6	12	4			80
Biophysicist		2	1						3
Botanical Artist			1						1
Botanist	10	11	7	3	4	8			43
Cadastral Engineer		1	1	1					3
Cartographer			4						4
Chemical Engineer	3	2	3	2	1				11
Chemist	91	114	85	42	52	19	1	1	405
Chief of Bureau								1	1
Civil Ingineer	8	2	1		1				12
Olub Organization Specialist					1				1
Color Technologist		1	1						2
Construction Engineer Consulting Architect		1	. 1						1
					,			1	1
Consulting Highway Engineer Consulting Mathematician					1			3	1
Cotton Technologist	2	7		2	7			1	
Cotton Grade and Staple Estmtr.	2	3		2	3				10
Crop and Livestock Estimator	4 11 -	7	3.6	8	7				4
Cytologist	II.	1	16	0					49



Class	P-1	P-2	P-3		ary G		P-7	P -8	Total
						-	dissiplication of the latest state of the late		
Dairy Husbandman		4	2	2	9				17
Dairy Manufacturing Specialist	1	5	6		2	1			15
Development Engineer			1						1
Director of Extension Work								1	1
Dir. of Personnel & Bus. Admin.							1		1
Director of Regulatory Work								1	1
Director of Scientific Work					A			1	1
District Forest Inspector					4				4 6
District Law Officer		2	2		6 7				
Drainage Engineer		2	2			1			11
Drug Control Inspector		,				1			1
Dust Explosion Engineer		1							1
Bcologist			1						1
Economic Geologist			1						1
Economic Zoologist					1				1
Ec onomist		1			2	1			4
Editor					1				1
Mectrical Engineer					1				1
Ingineer	3	11	10	7	11	7			49
Engineer of Tests			4	1	3				8
Intomologist	84	104	78	47	39	11	1	1	365
Prosion Scientist			2	6					8
Exhibits Specialist			1		1				2
Extension Forester				1	1				2
Extension Husbandman					2				2
Extn. Spec. in Home Management					1				1
Farm Economist					1				1
Feed Technologist			1						1
Field Agent - Negro Work			2						2
Tood and Drug Inspector	37	27	8	4	12	2			90
Food Control Inspector						1			1
Forester	135	27	14	3	12	5	1	2	199
Forest Ecologist		2	3	1					6
Forest Economist		5	1	2	9	3	1		21
Forest Inspector					2				2
Forest Products Engineer						1			1
Forest Products Statistician			1						1
Forest Ranger	2				1				3
Forest Supervisor		1	1						2
Forest Taxation Economist								1	1
all and a second			2	2	1				5
Geneticist			2	E.	2	2	1		5
Grain Exchange Supervisor	3				2	~	-		1
Grain Inspector	1	0	2						3
Grain Technologist		2	1						



<u>Class</u>	<u>P-1</u>	P-2	P-3		ary G		P-7	P-8	Total
Hide Specialist Highway Bridge Engineer Highway Economist Highway Engineer Highway Research Specialist Highway Transport. Engineer Home Demonstration Agent	99	1 6 3 69	1 18 1 97	6 1 45	14 2 69 4	22		1	2 46 7 402 4 1
Home Economics Specialist Home Economist Horticulturist Hydraulic Engineer Hydro-Electrical Engineer	6 3 1	7	6 19 1	10	2 5 12	5	1		21 5 56 2
Industrial Engineer Insect Pathologist Inspector of Grazing Irrigation Economist Irrigation Engineer		6	1	1 2	1 1	1			1 1 1 1 17
Laboratory Inspector Land Classification Specialist Landscape Architect Land Valuation Engineer Librarian Livestock & Meat Technologist Livestock Statistician Logging Engineer	1 25	1 1 14	2 1 1 7 1	1	1 1 1 5	1			2 1 3 4 47 1 1 9
Marketing Economist Marketing Specialist Market Milk Specialist Materials Engineer Mechanical Engineer Medical Officer Meteorologist Microanalyst Microscopist Mycologist	1 2 142 2	2 1 1 2 3 1 141 1	1 3 3 4 1 65	1 1 3 8 1	1 28 1 1	12 1 1		1	3 2 6 5 10 6 397 2 4 5
Naval Stores Classifier Naval Stores Inspetr. & Class. Nematologist Nut Chemist Olericulturist	6	4 1 1	2	1	1	1			5 1 11 2



Class				Sal	ary G	roun			
	<u>P-1</u>	<u>P-2</u>	<u>P-3</u>		P-5		P-7	P-8	Total
Parasi tol ogi st			1	2					7
Pathol ogi st	12	36	53	19	39	16			3 175
Petrographer	-~		1	13	05	10			
Pharmac ol ogi st	2		_		1				1 3
Physicist	2	4	5	1	î	1			14
Physiological Plant Anatomist		1		-	_				1
Physiologist	6	3	13	7	7	5	1		42
Plant Breeder	1	2					_		3
Plant Toologist				1					1
Plant Fistorian		1							1
Plant Physiologist			1	1					2
Plant Quarantine Administrator						1	1		2
Plant Quarantine Inspector	146	96	26	9	2				279
Pomologist	9	7	5	4	5	1		1	32
Poultry Husbandman	2		3		1				6
Poultry Technologist				1					1
Radio Engineer	1								
Range Examiner	22	6	5		2				1
Refrigeration Engineer	22	0	1		~				35
Regional Engineer			1		6				1 7
Regional Forester			7		20	7	1		28
Regional Forest Inspector			1	3	5	*	1		9
Research Assistant		1		Ü					1
									-
Scientific Assistant			1						1
Scientific Illustrator			1						1
Scientist					1				ī
Silviculturist		227	15	10	11	1			59
Soil Petrographer				1					1
Soil Scientist			3		6	2			11
Soil Surveyer	29	18							47
Soil Technologist		5	8						13
Solicitor								1	1
Specialist				1					1
Specialist in Cattle Breeding						1			1
Statistical Analyst					1				1
Statistical Engineer Statistician			1						1
Statistician Stock Yard Appraiser			1 2						1
Structural Engineer	2		2		2	-			2 5
Sugar Technologist	2	1	1		1	1			5
Surveyor	3	1	1						1
			1						1



Class				Sal	ary G	roup			
	<u>P-1</u>	b-S	P-3				<u>F-7</u>	P-8	Total
Taxation Economist				2					2
Tea Examiner		3	1						4
Technical Reviewor				1	2				3
Technical Writer Technologist		1							1
Textile Technologist	3		3	1	3				10
Timber Expert	T		2						1 2
Title Attorney			6						6
Toxicologist					1				1
Transportation Economist					1				1
Truck and Fruit Crop Estimator			5						5
Veterinarian	249	890	1 21	17	41	7	1	3	1327
Veterinary Sanitarian	3		2 ~2		~~	·		-	3
Visual Instr. Specialist				1					1
Wood Technologist		1	3	2	1				7
Wool Technologist		_		1	_				1
Xylotomi st	1					1			2
AJ 10 COME SO	1					ī			2
Zoologist	6	5	3	1	2	1			18
Totals	1263	1837	982	370	6 59	203	15	17	5346



Total	Plant Quar. & Cont. I Public Roads Weather Bureau	Home Economics Information Library Plant Industry	Extension Service Food and Drug Admin. Forest Service Grain Futures Admin.	Chemistry and Soils Dairy Industry Entomology Experiment Stations	Agricultural Econ. Agric. Engineering Animal Industry Biological Survey	Bureau
	Adm.					Principal Classes of Positions
144	pu	سو	ಬ	∾	138	Agricultural Econ.
38			ب	سو	36	Agric. Engineer
145	J.	134	∾	7 1		Agronomist
38				~	31	Animal Husbandman
80					76	Biologist
43		4		ಹ		Botanist
405	40	ω თ	159 24	154 20 3	27	Chemist
365	15		ഗ	343		Entomologist
5 90	•		5 90	70 04		Food & Drug Inspector
199		σ	179		ro To	Forester
402	402					Highway Engineer
46	46					Highway Bridge Engnr.
56	4	\$	H	7		Horticulturist
397	397	L				Meteorologist
168	10	63	سا			Plant Pathologist
39	P	36		∾		Plant Physiologist
279	279					Plant Quar. Inspector
32		32				Pomologist
47				47	b →	Soil Surveyor
1330			Ch	g-vil	1323	Veterinarian

Table No. 5. - Location, by Bureaus, of Principal Classes of Professional Positions



Table No. 6. - Distribution of Employees in the Professional Service by Grade or Salary Groups and Highest Academic Degree

Degree	P-1	P-2	P-3	P-4	-	ry Gr		P-8	Total	Per Cent
None	164	231	153	45	81	13	2		689	12.8
Bachelor	702	439	384	141	241	61	3	3	1974	36.9
Master	143	232	210	98	163	43	2	4	890	16.6
Ph.D.	1	43	110	65	114	53	4	3	393	7.3
M.D.	1	2	3	3	8	2			19	0.3
D. Sc., D. Agr.,. D. Engr.,										
L.L.D.,Litt.D., D.C.L.				3	9	23	3	6	44	0.8
D. V.M., V.S., D. V.S., etc.		890	122	20	43	8	1	1	1337	25.0
Total	1263	1837	982	370	659	203	15	17	5346	99.7



Table No. 7. - Percentage, by Bureaus, of Professional Employees
Holding the Academic Degrees Indicated.

	Mumber of Employees	No Degree	Bachelor	Master	Ph. D.	14. D.	D.Sc., D.Agr., D.C.L. L.L.D., Litt.D.	D.V.S., D.V.M., V.S., etc.	
Agricultural Econ. Agric. Engineering Animal Industry Biological Survey	276 81 1442 100	6.1 0.3 23.0	43.1 77.7 4.0 49.0	31.1 16.0 2.3 19.0	0.9	.3	.7	91.9	99.8 99.8 99.6 100.0
Chemistry and Soils Dairy Industry Entomology Experiment Stations	3303 76 363 43	3.9 13.1 6.3 6.9	45.5 44.7 49.0 44.1	25.1 22.3 26.1 27.8	23.4 17.1 17.0 11.6	0.6	1.3 1.3 1.3 2.3	1.3	99.8 99.8 99.7 99.6
Extension Service Food & Drug Admin. Forest Service Grain Futures Admin.	43 302 469 8	18.6 13.8 5.7	44.1 56.3 47.7 50.0	23.2 19.8 40.0 37.5	6.9 4.9 5.1	2.6	6.9 0.3 1.2 12.5	1.6	99.7 39.3 99.7 100.0
Home Economics Information Library Plant Industry	33 4 16 524	0.3 25.0 25.0 4.1	21.2 75.0 75.0 36.2	95.4 32.6	30.3		2.8		98.2 100.0 100.0 99.7
Flant Quar.& Cont.Adm. Public Roads Secretary's Office Weather Bureau	311 502 52 398	12.2 20.5 28.8 77.8	78.7 69.1 53.8 16.5	8.3 9.5 11.5 2.5	0.6 0.6 1.9 2.0	0251	0.2 3.8 0.5		99.8 99.9 99.8 99.8



Table No. 8. - Distribution of Employees in the Professional Service

by Age and Salary Group Attained

		0,4 1	ugo an	d Sala	ry Gro	up Att	ai ned			
Ago									April	1931
		72 1	70.0		Salar	y Grou				Total
21		<u>P-1</u>	P-2	P-3	P-4	P-5	P-5	P-7	P-8	
55		4								4
23		18								18
		51								51
24		84	4							88
25		99	17	1						117
5_		89	24	1						114
2.7		95	31	9						135
25		1-5	41	11	1					158
20		8~	50	14	5					
7		53	4.	15	5	· ·				154
21		52	64	27	6	3				119
73						4				153
.13		42	75	55	10	2	1	1		157
31		40	49	35	9	6	4			1 43
		32	61	34	11	6				144
35		46	59	37	15	8				1 65
36		47	72	45	16	12	1			194
37		37	75	42	14	10	1			180
78		55	79	50	53	18	3	1		195
マコ		33	56	32	23	SI	5			170
		28	68	3IP.	230	23	5			178
		31	69	49	23	31	8			21.1
		20	63	45	26	39	7	1		50.5
2.5		21	65	43	1?	31	7	1		185
-1-1		15	61	27	15	25	6		1	1 50
45		13	56	36	15	28	7	1	1	157
45		9	54	30	11	35	6	ī	ī	147
47		18	45	22	15	42	8	_	_	150
48		4	52	28	8	23	6	1	1	123
49		12	43	25	4	31	8	7	7	
50		8	50	24					2	123
					6	25	12		1	126
51		5	46	18	15	32	11	1		128
52		4	43	19	5	23	6	S	1	103
53		6	26	19	5	24	6		3	89
54		3	44	55	7	17	7		S	102
55		7	28	18	5	10	6			74
56		S	31	14	7	20	10		1	85
57		1	26	11	7	6	10			61
58		2	28	S O	1	19	4	1		75
59		3	39	11	6	8	8	1		76
60		2	18	14		9	4	1		48
61		1	16	18	2	7	4	ì		49
62		1	16	13	2	11	S	-		45
63		į	6	17	S	7	2			35
64			12	6	1	9				
65			6	3	1		8	2	2	36
66					1	4	2	1	1	18
		2	6	3		4	3			16
67		2	6	3		4	3			18
68		3	9	8	1	4	5		2	32
69		1	3	2		6	1			13
70		2		S	1	3	2			10
71		1	S			3				6
72		2	S	1	1	1	1			8
73		1		1			1		2	5
74				ı			2			3
75				-		1				1
	Mark 1		0.50	000	P.P.		00.7	3.5	3.0	
	Total	1 263 1	.837	982	370	659	203	15	17	5346



S

Total



Table No. 10. - Distribution of Professional Imployees in the Salary Group \$5600 to \$6400, by Institutions from which the Highest Academic Degree in Course was Received

Institution	No. of Employees
American Veterinary College	1
Armour Institute of Technology	ī
Brookings Institute	5
Chicago Veterinary College	1
Colorado School of Mines	ī
Colcrado State Agric. College	2
Columbia University	3
Columbian University	3
Cornell University	16
Cotner University	1
Emporia College	ī
George Washington University	8
Georgetown University	3
Georgia School of Technology	1
Harvard University	8
Harvard Veterinary College .	1
Indiana University	1
Iowa State College	4
Johns Hookins University	6
Kansas City Veterinary College	1
Kansas State Agricultural College	7
Lehigh University	1
Maryland Agricultural College	2
Massachusetts Agricultural College	2
Massachusetts Institute of Technology	1
McGill School of Comparative Medicine	1
Michigan State College of Agriculture	2
Mississippi Agricultural College	1
National Normal University	S
National University of Law	2
New Hampshire Agricultural College	1
New York State College of Forestry	1
Ohio State University	4
Onio University	1
Oklahoma A. & M. College	1
Ontario Veterinary College	1
Pannsylvania State College	1
Purdue University	4
St. Ignatius College	1
St. Johns College	1
Sheffield Scientific School	1
State College of Washington	1
State University of Iowa	1
State University of Kentucky	1
Stanford University	S
Syracuse University	1



Institution	No. of Employees
Tufts College	1
Union College	1 3
University of	3
Arkansas	1
California	6
Chicago	1
Colorado	1
Florida	i
Heidelberg	1
Illinois	7
Jena	
Maine	2
Maryland '	1 2 2
Mi chi gan	10
Minnesota	5
Mi ssouri	6
Nebraska	3
Wisconsin	10
Utah Agricultural College	1
Virginia Military Institute	ī
Virginia Polytechnic Institute	2
Wabash College	1
Washington and Lee University	î
Worcester Polytechnic Institute	ī
Yale School of Forestry	6
Yale University	7
No degree in course	16
Total Employees	203
Total Institutions	71

Table No. 11. - Distribution of Agricultural Economists by Salary Group and Institution Which Conferred First Academic Dogree

Institution									
,	P-1	P-2	P-3	P-4	Fal ary			F 0	Mo. 4 = 3
A. & M. College of Texas			Windleston.		1-0	Leo	P-7	<u>F-8</u>	Total
Allegheny College	8	8	1		3	1			21
Carbeton Collage				1					1
Clamson Agric. Collago	_		1						1
Colgate University	S	S			1				5
Columbia University	1					1			1
Colorado Agric. College	Τ.	1	1						2
Jornell University		1	2		1				5
Earlham College		Τ.	J T		1				3
George Washington University			1						1
Georgia School of Technology	1		7						1
Gustavus Adolphus	-				1				1
Harvard University			1		1	1			1
Heidelberg College			-		1	Т			S
Ica State College	1	1	5		*				1
Kansas State Agric. College		2	2		1		_		7 5
Louisiana State University			1		24				1
Luther College								1	1
Macalaster College					1			2.	1
Massachusetts Agric. College		3			1	1			5
Michigan State College of Agric.		1							1
Morningside College				1					ī
New Mexico College of Agric.		1							ī
New York State College of Forest. North Carolina State College	•	1							1
Onio State University				1					1
Ohio University			1		1				2
Oklahoma A. & M. College	2	2				1			1
Oregon State Agric. College	1	4	1		,				5 3 2
Pennsylvania State College	1		1	1	1		1		3
Pomona College			T	1	1				
Purdue University				1	1				1
Stanford University			1						1
State College of Washington		2	ī	1					1
State University of Iowa			_	-	1				1
The Citadel		1			-				1
University of									_
Alabama			1						1
Arizona					1				1
Chicago					1				i
Denver		1							î
Georgia	1	1							2
Illinois			4	1	2				7
Kansas							1		1
Kentucky			1						ī
Maryland				1					1
Michigan		1		1		1			3



Institution		Salary Group							
	<u>P-1</u>	P-2	P-3	<u>P-4</u>	P-5	<u>P-6</u>	<u>P-7</u>	<u>P-8</u>	Total
University of									
Minnesota		1	2	2	3				8
Mi ssouri			1	2	2	1			6
Nevada		1							1
Rochester					1				1
South Daketa			1						1
Tennessee			1						1
Vermont		1							1
Washington .	1								1
Wisconsin		1	1	1	3				6
Utah Agric. College					1				1
Whitman College		1							1
William Jewel College						1			1
Williams College		1							1
Non Graduates	1	1	1	1	1				5
	-								
Totals	19	36	33	15	30	8	2	1	144



Table No. 12. - Distribution of Agronomists by Salary Groups and Institution Which Conferred First Academic Degree

Institution						Grou			
	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	Total
A 0 W 0-73						,			2
A. & M. College of Texas	,					1			1
Brigham Young University	1		A	1					5
Clemson Agricultural College		,	4	1	-				5
Cornell University		1	1		3				ĭ
East Texas Normal		,	1						i
Emory University Harvard University		1							î
Illinois Wesleyan University		Τ.				1			ī
Iowa State College		3	1	1	1	_			6
Kansas State Agric. College	2	4	14	2	3	3			28
Louisiana State University	2	ו	7.4	ĩ	Ü				2
Mississippi A. & M. College		_		-		1			1
Missouri College of Agriculture					1	_			1
Montana State College	1	2	4						7
New Mexico A. & M. College	_		1						1
North Dakota Agric. College	1		3		1				5 1
Northwestern University				1					1
Oklahoma A. & M. College			1	1					2
Oregon State Agric. College	2	2	3		1	1			8
Purdue University	1				2				3
South Dakota Agric. College		1	4		1				6
Syracuse University		1							1
University of									
Arizona		1							1
California	2		1						3
Delaware		1							1
Idaho	1	1							2 4
Illinois		1	1	1	1				
Maryl and			1		1				2
Mi chi gan		1	2			1			4
Minnesota	2		1	1		_			4
Missouri		1	3			1			5 2
Montana	1		1			,			5
Nebraska	1	2		1		1			่ว
Nevada			1						1
New Hammshire			1		,				1
North Carolina			,		1				1
Saskatchewan			1						1
Tennessee			1						2
Wisconsin			2		2				6
Utah Agricultural College	1	_	3		2				2
Virginia Polyt. Institute		2	,						1
Washburn College		2	1 3			2			7
Non Graduates		2	3						
Mot ol -	16	29	60	10	18	12			145
Totals	10	25	~	10	20				



Table No. 13. - Distribution of Chemists by Salary Group and Institution Which Conferred First Academic Degree

Institution				S	alary	Group		
Grant State Communication Control of the State Cont	P-1	P-2	P-3			P-6 P-7	F-8	Total
Mabama Polytechnic Institute		S			1			3
Amherst College		Ş		٦	-			1
Antioch College				ì				î
Bases College		1						î
Baylor University		_	1					ī
Bethany College			1					1
Brigham Young University	1		_					ī
Butler College	_		1					1
California Inst. of Technology				1				1
Carbeton College					1			1
Catholic University			2					2
Chalmers Inst. of Technology		1						1
Central College		1						1
Clark College	1		1					2
Clemson Agric. College		1						1
Coe College				1				1
College of the City of Detroit	1							1
College of the City of New York		2			1			3
College of Emporia	1							1
College of the Holy Cross	1							1
Columbia University	5		1	1				4
Cooper Union			1					1
Cornell College (Ia.)		1		-				1
Cornell University	2	2		1	4	1		10
Dalhousie University			,		1			1 2
Dartmouth College	1		1					1
Davidson College		-	1		1			2
De Pauw University		1	,		<u> </u>			1
Dickenson College	2		1					3
Drake University	1		Ŧ		1			2
Emory University Fairmount College	1	1	1	1	T			3
Franklin College		1	1	1				1
George Washington University	7	8	5	6				26
Georgia School of Technology	'	Ü		· ·		1		1
Gettysburg College						ī		ī
Gonzaga University		1				- ·		ī
Guilford College		ī						1
Hamline University		•	1					1
Harvard University		1	1 1	4	3			9
Haverford College		•	1					1
Heidelberg College					1			1
Hendrix College	1							1
Hiram College		1						1
Indiana State Normal		-	1					1

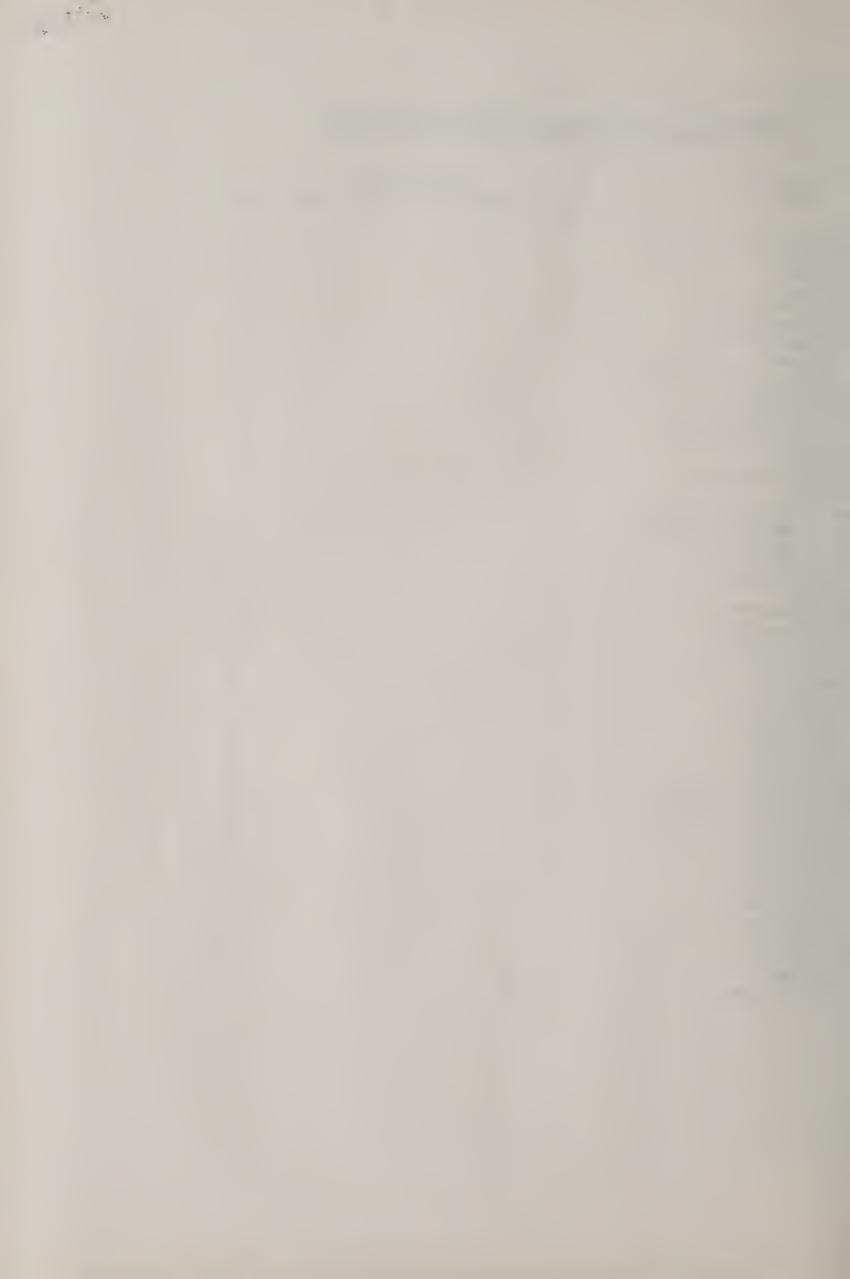


Table No. 13, Continued.

Institution				c	a] awa	Om	_		
	P-1	P-2	P-3	P-4	alary P-5	DE 6	P-7	<u>r-8</u>	Total
		-	-				-	1-0	10/41
Indiana University	1				1				2
Iowa State College		1	1		_				2
Johns Hopkins University				1		1			2
Kalamazoo College				_	1	_			1
Kansas State Agric. College	1	2							
Lawrence College	1		1	1	2				3 5
I onoir College	1								1
I owis Institute	1								1
Louisiana State University			2		1				3
Manchester College		1							1
Marietta College	1			~					1
Marquette University				1					1
Maryland Agric. College			2			2			4
Massachusetts Agric. College		1							1
Massachusetts Inst. of Technology	y		3	1	1				5
McTherson College		1							1
Michigan State College of Agric.		1			1				2
Middlebury College		2							.5
Milligan College		1							1
Mississippi A. & M. College	3	2		1					6
Monmouth College	1								1
Montana State College	3	1							4
Morningside College			2						S
Mt. Holyoke College	1								1
National University	1		1						2
Nebraska Wesleyan University	1		1						2
New York University	1	1							2
North Dakota Agric. College				1					1
Northeastern University	2								2
Northwestern University		2							2
Oberlin College	1								1
Chio Northern University	1								1
Ohio State University			5						5
Chio University						1			1
Oklahoma A. & M. College	1		1		1	1			4
Oregon State Agric. College	3			1					4
Pennsylvania State College	1	1	3						5
Philadelphia College of Pharm.			1						1
Princeton		1	1		1	1			4
Purdue University		2			1				3
Randolph Macon College		1							1
Rensselaer Polytechnic Inst.			2						2
Rhode Island State College		1							1
Richmond College		1	1						1 2 1 2 2
Ripon College		1				1			2
Rose Polytechnic Institute	1								1
St. Olaf College			1						1



Pable No. 13, Continued

Institution				S	alary	Group	,		
	P-1	F-2	P-3				P-7	P-8	Total
21 21 a.h A.22									
St. Viator College			1						1
Simmons University	1								1
Sheffield Scientific School			3		2				5
Simpson College				1					1
Smith College	1				1				2
South Dakota State College	5	1							2 3
South W. Missouri St. Teachers	1								1
Collega									
Stanford University		1 2		1	1				3
State College of Washington	2	5		1					5
State University of Iowa		2			1				3
Statson University	1								3
Syracuse University		4							4
Tarki o College				1					1
Trinity Collego	1	1							2
Tufts College	1	1		1					3
Tulane University		1							1
University of									
Arkansas	2	3		1					6
Budanest					1				1
California		3	4			1			8
Chicago	1		1	1					3
Cincinnati	1	1			1	1			4
Dol awar e		1							1
Denver		1	1						1 2 1
Morida				1					1
Georgia		1							1
Illinois	1	5	5	3	3				17
Kansas					2				2
Kentucky				1	2				3
Louisville		1							1
Maine	1	2	1	1	1				6
Maryland	2	3			1	1			7
Michigan		2	3	1	2	1			9
Minnesota	1	2							3
Missouri		1							9 3 1
Kontana	2								2
Nebraska •	3	4	1		1				9
New Hamoshire				1					3
North Carolina	1				5				3
Notre Dame		1							1
Omaha		ī							2 9 3 1 1 2 4 3
Oregon	1	1							2
Fennsylvania		S	1		1				4
Pittsburgh		2	î						3
St. Petersburg				1					1
South Carolina	1			-					î
	-								•



Table No. 13, Continued.

	Institution				5	Salary	Gron	o		
		<u>P-1</u>	P-2	P-3					F-8	Total
Univ	eraity of "									
	South Dakota	1								1
	Tennessee	-	1							i
	Vtah	1		2						3
	Virginia	_	1	~	1					3 2
	Washington	1	ī	1	_				1	4
	Wisconsin	ī	3	_	3	2			-	
	Virginia Military Institute	e 1	Ŭ		Ü	~				9
	Virginia Polytechnic Insti-	10	2			1	1			5
	tute					-	-			
	Wabash College						1			1
	Washington and Lee Universi	ity		1						1
	Washington University	2		1						
	Wesleyan University						1			3 1 1
	Western Polytechnic Institu	ate		1						1
	Western State Teachers Col-	- 1								1
	l ege									
	Westhampton College	1								1
	Westminster College						1			1
	Whitman College	1	1							2
	Whittier College	S								2 2 1
	Williams College						1			
	Worcester Polytechnic	1	1	S	1	2				7
	Institute									
	Yale Variable College	1				1				2
	Yankton College	1				-				
	Non Graduates	4								5
	Totals	95	111	79	45	55	19		1	405

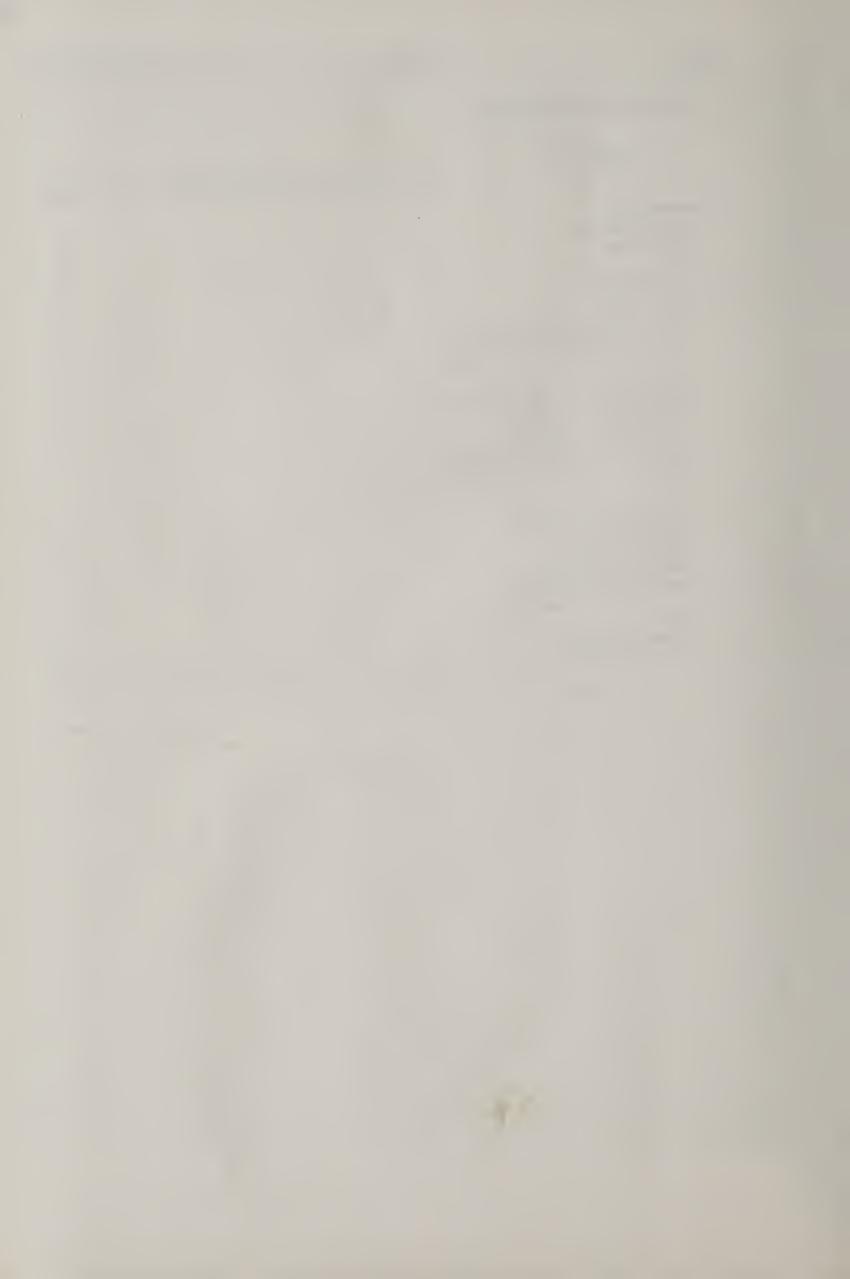


Table No. 14. - Distribution of Plant Pathologists by Salary Group and Institution Which Conferred First Academic Degree

Institution				S	alary	Grou	p		
	P-1	7-2	P-3	P-4				P-8	Total
Matama Polytochnic Institute			1		1				2
Bates College					1				1
Baylor University			_		1	-			1
Brown University		3	1		1	1			5 2
Clemson Agric. College		1	1	-					4
Colorado Agric. College		1	2	1					
Connecticut Agric. College				1	,				1 5
Cornell University	1		3		1				3
Dartmouth Collage			3		1				1
Tureka College	,	2	1						
George Washington University	1	2				3			3 1
Harvard University						1			1
Heidelberg University	1								1
Indiana State Teachers College	T				1	1			2
Indiana University Iowa State College	1	1			_	_			2 2 4 2 2
Kansas State Agric. College	1	1	2		1				4
Massachusetts Agric. College	1	<u>.</u>	~		î				2
Miami University	•		1	1					2
Michigan State College of Agric.		1	3	ī	3	1			9
Mississippi A. & M. College		-	2	_	1	_			3
Montana State College			~		ī				1
New Jersey Agric. College		1			_				1
New Mexico A. & M. College	1	_							1
New York State Coll. of Forestry	_				1				1
North Dakota Agric. College			1						1
Ohio State University			2	2					4
Oregon State Agric. College	1	4	1						6
Pennsylvania State College			2	1					3
Purdue University	1	2	ı	ī					5
Randolph-Nacon College	_				1				1
Smith College		1	1						2
South Dakota State Coll. of Agr.		_				1			1
Stanford University		1	3	2					6
State College of Washington		3		1	1				5
Theol. Seminarium (Russia)					1				1
Toronto University					1				1
Union College			1						1
University of									
California	1	1		1	1				4
Florida			5						2
I daho	1		2						3
Illinois			*		1	5			3
Kentucky			1	1	1				3
Maine			1		1				5
Maryland					1				1
Michigan	1	1	3						5
		-							



Table No. 14, Continued.

<u>Institution</u>	P-1	<u>B-S</u>	<u>P-3</u>	<u>P-4</u>	alary P-5	Grou P-6	P-7	P-8	Total
University of									
Minnesota		4	3	2		5			11
Mississimi						1			1
Nebraska		3	1		4	3			11
New Hampshire				1					1
Pennsylvania			1						1
Tennessee					1				1
Texas					1				1
Vermont					4				4
Washington West Virginia		1		1					2
Wisconsin		1	4	0					1
Wyoming		1	4	S	1				8
Utah Agric. College			1						1
Virginia Polytechnic Inst.		٦	Ţ		7				2
Wabash College		1.			1				1
Washburn College		7			1				1
Wichita University		ī							i
Non Graduates	1				1	1			3
Totals	12	36	49	19	38	15			169



Table No. 15. - Distribution of Entomologists by Salary Group and Institution which Conferred First Acad mic Degree

Institution				S	alary	Group		
	<u>P-1</u>	<u>F-2</u>	P-3			P-6 F-7	F-8	Total
. A. V. Callians of Manag	,	2		1	7			5
A. & M. College of Texas	1	4		1	1			5 2
Alabama Polytechnic Institute	1			Ţ				
Arkansas State Normal	1	3						1
Barnard College	٦	1						1
Bathany Gollege Boston University	1	1		1	7			1 7
	7	Τ.		1	1			3 1
Caldwell University Clark College	1				7			1
	3	5	2	1	1			13
Clemson Agric. Collage	2	3	1	Ţ	Ţ	7		
Colorado Agric. College	4	3	1	1	1	1		7 2
Columbia University Connecticut Agric. College	2	3	3	<u> </u>	1			8
Cornell University	1	3	4	3	2	1		11
	7		**	42	E	1		1
Delaware Agric. College Drake University	1					Ţ		1
	1			1				1
George Washington University		1		1				1
Goucher College		1			3			1
Harvard University	,				1			1 °1 1
Hastings College	1	1						1
Heidelberg College		1			7			1
Indiana University	2	,	_	7	1			6
Iowa State College	4	1	S	1				
Iowa Wesleyan College	-	1	A		7		1	1
Kansas State Agric. Ollege	1	6	4		1		1	13
King College	-	1 5	7					7
Louisiana State University	1	5	1					í
Marietta College	10	7.4	10	6	6	2		48
Massachusetts Agric. College Miami University	10	14	10	0	0	6		1
Michigan State College of Agr.		1	Α					5
	7.7	1	7	3				34
Mississimmi A. & M. College Nonmouth College	13	11	í	ی				1
	3		1		1			4
Montana State College New Hammshire State Col. of Agr.		1			7	2		3
New York State College of Forest		1 3				Z		3
North Carolina State College		3	71			1		3
Ohio Northern University	1		1			1		3
Ohio State University	7	8	3	2	2	1		17
Oklahoma A. & M. College	7	0	1	1	ی	<u> </u>		
Oregon State College	4	1	T	2				2 7
Pennsylvania State College	1	1	ı	L	1	1		5
	1	T	1	1	1	*		3
Pomona College		7	T	1	1			1
Reed College		1	3					1
Royal University (Copenhagen)			1	1				1
Rutgers College			. 1	1				1
South Dakota State Col. of Agr.			1					1

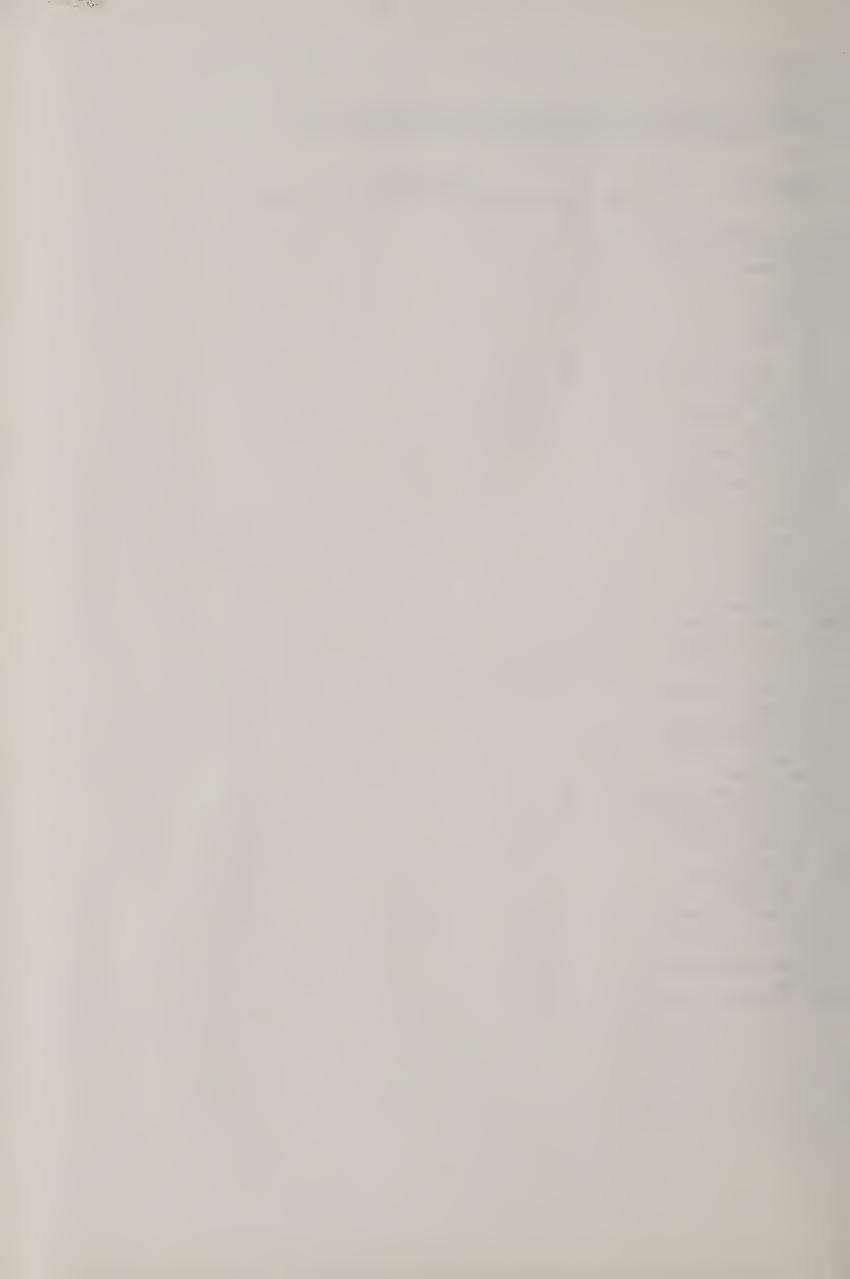


Table No. 15, Continued.

Institution					1-1 -m-	0			
400 to demonstrate de major de	P-1	P-2	P-3	P-4	alary			70 0	Motel
		1-0	1-0	1-4	1-0	1-0	P-7	<u>P-0</u>	Total
Stanford University		2	2	2	4				10
State College of Washington			1	~	i				
State University of Iowa			1		-				2
Storrs Agric. College			1						1
Syracuse University			1						1
Toronto University		1				1			2
University of									
California	S	S	S	2					8
Colorado		1		1					8 2 1 1
Copenhagen					1				1
Delaware	1								1
Denver		1							1
Florida	1		1						:2
Idaho	1		1	1					3
Illinois	7	4	1	1	1				14
Kansas	5	4		2	2				13
Maryland	1	1		2	1	1			6
Michigan					1				1
Minnesota	S	S							4
Mi ssouri	1	1							2
Montana	1		1						2
Nebraska	1		1						2
Now Hampshire	1	2	1		1				5 1
North Dakota			1						1
Pennsylvania			2	1					3
South Carolina	1								1
Tennessee		2	1						3 1 3 2 4
Utah		1	1						2
Wisconsin	1			2	1				
Utah Agric. College				2					2
Vanderbilt University				1					1
Virginia Polytichnic Inst.		1		1	1				3
Washington University	1								1
Whitman College	1								1 1 1
Yale University				1					
Non Graduates	3	5	10	2	2	1	1		24
Totals	84	104	78	47	37	13	1	1	365



Table No. 16. - Examinations held in 1930, and Number of Approintees therefrom by Grades, from January 1, 1930 to May 31, 1931.

:	P-1	: <u>F-2</u>	<u>r-3</u>	<u>7-4</u>	<u>F-5</u>	P-6	Total
	,	: _				•	
Junior Pamer Technologist : Paper Technologist :	7	: _	_	-	_	: - :	1
Jr. Animal Fiber Technologist (Wool & Mohair)	1	:	: _	1_	<u>-</u>	: -:	i
Assistant Soil Technologist (Soil Fertility):	_	: 5	: _ :	= _	: _	:	5
Junior Plant Quarantine Inspector	51	; –	• _	_	: _	: _ :	51.
Junior Agronomist	7		: _	• _	: _	: _ :	7
Jr. Agronomist (Western Irrigation :		:	•	•	•	:	
Agriculture):	S	: _	: _	: _	: _	: _ :	2
Assistant Forage Cron Agronomist :		: 7	: _	: _	: _	: _	7
Assistant Sugar Beet Agronomist :	_	: 3	: _	: -	-		3
Associate Agronomist(Dry Land Agriculture)	-	-	: 1	: -	: -		1
Junior Animal Husbandman (Horse Investigations) 1	: _	: _	: _			1
Senior Dairy Husbandman (Extension)	-	<u> </u>		-	1	-	1
Junior Biochemist (Horticulture)	1	: -			• -		1
Associate Biochemist (Animal Body Fluids)	_	: _	1				1
Junior Biologist (General) Junior Biologist (Poultry)	S				: -	-	2
Junior Biologist (Poultry)	3	: -	. –	: -		: -	3
Junior Biologist (food Habits Research)	2		• -	: -	:	-	2 2
Assistant Biologist (Food Hooits Research)-	-	: 2	: -	:	:	: -	: 5
Juni or Nematologist	2	: -	:	:	:	: -	: 2
Junior Fathologist Junior Fathologist (Flant Quarantine	4	:	:	:	: -	:	: "
Inspection)	10	: _		: _	:	:	10
Assistant Flant Pathologist (Vegatable	10	: -	:	:	: -	:	: 10
Dispases)-	_	: 1	: _	: _	: _	: _	: 1
Assistant Flant Fathologist (Vegetable		:	*	:	:	:	: -
TV	_	: _	: 4	: _	: _	: _	4
toward at a Table of and at (Oursey Cours)	_	: _	: 2	: _	: _ :	: _	2
Associate Fathologist (Forage Crops)	-	: _	: 1	: _	: _	: -	1
Associate Pathologist (Sugar Cane)	_	: _	: _	: 2	: -	-	2
Plant Pathologist (Vegetable Crops)	_	: _	: _	: 1	: _	-	1
Pathologist (Sugar Cane)	_	: _	: -	: 2	: -		2
Senior Pathologist (Cereal Snuts)	_	: -	: -	_	1	: -	1
Semi or Pathologist (Barberry Eradication)	_	<u> </u>	: -	: -	: 1		: 1
Junior Physiologist	- 1	: -	: -	: -		: -	1
Associate Physiologist (Fruit & Nut Invest.)	_	: -	1	. –	. –	-	1
Physiologist (Fruit & Nut Investigations)	-	· -	: -	: 4		-	4
Juhi or Pomo logist	2		• -			-	2
Senior Fomologist	-	• -	• -	• -	2	: -	2
Jumior Seed Fotanist	4	: -	; -	-	: -	: -	: 4
Juni or Soil Surveyor	: 3	:	: -	: -	: -	-	: 26
Junior Chemist	: 26	: -	: -	: -	: -	: -	: 1
Assistant Chemist (Advanced Inorganic)	: -	: 1	: -	: -	: -	: -	: 2
Assistant Physical Chamist	-	: 2	: -	: 1	_		: 1
Chemist (Vegetable Biochemistry)	: -	: -		: 1	. 1	• -	; 1
Senior Physical Chemist					: 1		: 1
Senior Food Chemist					• 1		: 4
Junior Librarian	4-			•	•		:
Junior Home Economics Specialist (Clothing Design)-	• 7	•		: -	: -	:	: 1
		:	:				:
Jr. Home Economics Specialist(Foods and	: 1			: -	: -	: -	: 1
Nutrition)	. 1	•	•		•		

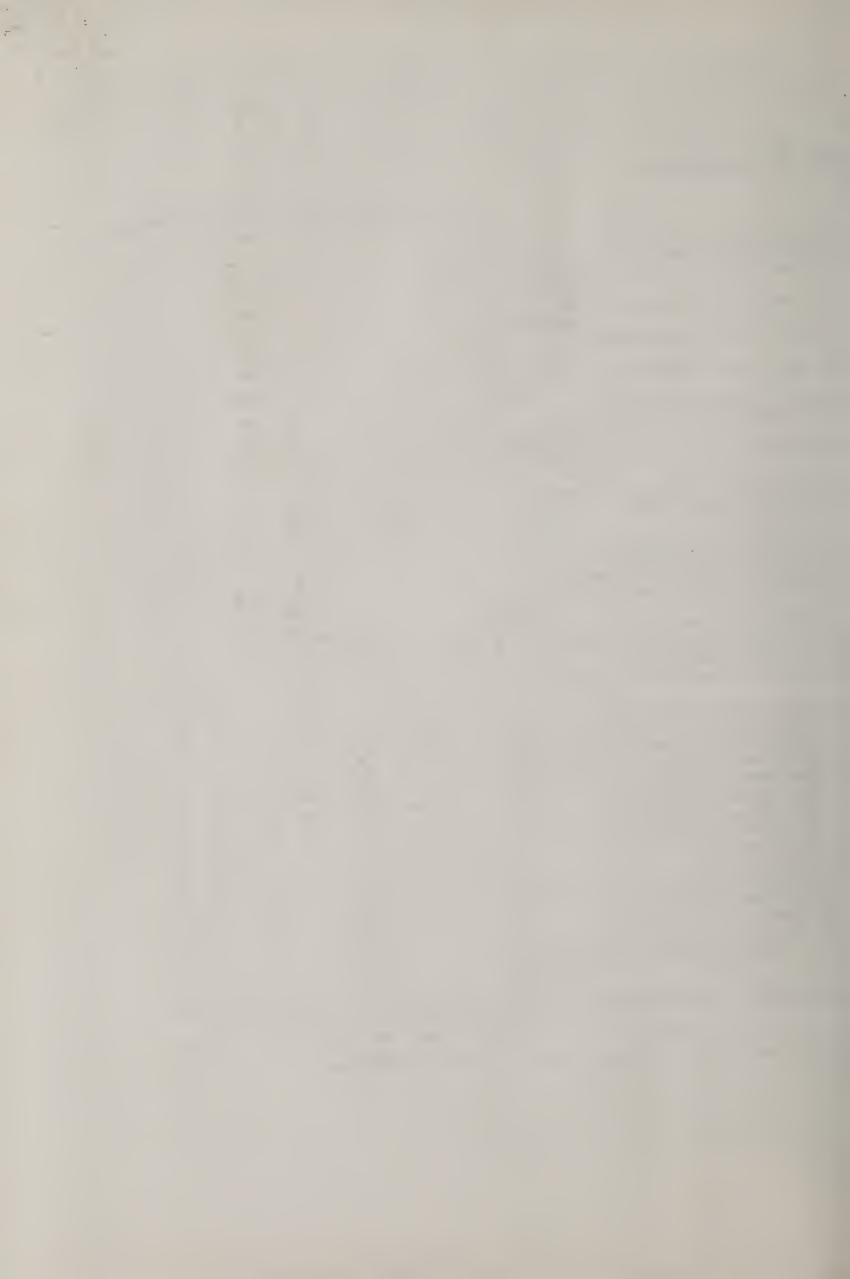


Table No. 16, Continued	ובת	· F-2	. 50 77	. 5.4	. 5 5	. 5 6	Mak - 3
Home Economics Specialists		:	:- <u>F-3</u>	1-4	F-5	1-0	Total
Junior Civil Prairies	-	: -	: - ;	1	-	-	1
Junior Mechanical Engineer	37	: -	: - :	-	-	-	37
Home Economics Specialist Junior Civil Engineer		: -	: - ;	- :	- ;	-	1
Junior Chemical Engineer	; }	: -	: - :	- ;	; - ;	-	1 2
Assistant Chemical Engineer-	3	. 1	: - :	- :	_	_ :	ı
Assistant Civil Engineer		: 1	: - ;	_ ;	- 1		3
Assistant Highway Engineer		. 14		_ :			14
Asst. Structural Steel & Concrete Bridge Engr.	_	. 2		_	_	_	2
Assistant Material Engineer	~	: 1		_	_	_	2
Assistant Hydraulic Engineer		: 1	• - •	- 3	_	_	1
Associate Agricultural Engineer	_	: -	3	- :		- 1	3
Associate Chemical Engineer	_	: -	1	-	-	-	1
Associate Civil Engineer	-	: -	: 1:	-	-	-	1
Associate Highway Engineer	-	: -	: 17:	-	-	_	17
Assoc. Structural Steel & Concrete Bridge Engr Civil Engineer Senior Civil Engineer Senior Architectural Engineer Senior Agricultural Engineer (Extension		:	:			- - -	
Engr	-	: -	: 3 :	_ ;	- :	-	3
Conion Civil Engineer	-	: -	: -:	1 ;	- :		1
Senior Utvil Engineer	_	: -	: - :	- :	2	- :	2
Senior Architectural Engineer	_	: -	- :	- :	: ¹ :	-	1
Senior Agricultural Engineer (Extension	}	•	:			:	{ ,
Junior Forester	47	: -	: -:	_ ;	· · · :		1
Punior Ranga Eveninar	12	: -	- :	_ ;	- :		47 12
Timber Expert	12		7 .	_ :	_ ;		3
Junior Wood and Drug Inspector	16			_ :	_ :		16
Junior Veterinarian	57	• -		_		_	57
Senior Agricultural Engineer (Extension Specialist) Junior Forester	6	• _		_ :	_	_	6
Junior Bacteriologist (Food Products)	1	• -	• - •	_ :	- :	-	1
Assistant Bacteriologist (General)	_	1		_ ;		_	ī
Assistant Bacteriologist (Food Products)	_	1		_ ;		-	1
Associate Bacteriologist (Food Products)		_	2	_ ;	_	-	. 2
Junior Entomologist(Insect Habits & Develop-							•
ment)	10	-	-	- :	-	-	10
Junior Entomologist(Insecticide & Physiology Junior Entomologist(Cultural Control)	1:	-	- :	- ;	-	_	1
Junior Entomologist(Cultural Control)	9 ;	- :	- :	-	-	-	. 9
Junior Entomologist(Taxonomy)	2 :	- :		-	-	-	2
Assistant Entomologist (Aniculture)	- :	1:	- :	-	-	-	1
Asst. Entomologist (Biological Control of In-	;		:	:	:		
sects)-	- :	2	-:	-:	- :	-	2
Asst. Entomologist (Cereal & Forage Insects) -:	- :	1:	- :	- :	-:	- :	1
Asst. Entomologist (Cotton Insects)	- :	1 2 1	-:	•	- :	_ :	2
Asst. Entomologist (Forest Insects)	-:	1:	- - 2	_ :	_ :		1
Asst. Entomologist (Truck Crop Insects)	-:	٤:	~ :	_ :	-:	_ :	2 2
Associate Entomologist (Apiculture)	-:	-:		7	_ :		
Assoc. Entomologist(Tronical & Subtronical Insects)	**			- :			
Angel Entered or of the (Throne Com Throats)	207		2 :		-	-	: 1 : 2
Assoc. Entomologist (Truck Crop Insects): Entomologist		• –		3 :			: 3
Entomologist (Insect Ecology)	_	-			- :		: 2
Sr. Entomologist (Cereal & Forage Insects)-:		_			2 :		2
Junior Physicist	1	_	- : - :				: 1
Assistant Siviculturist		7	:				7
Sitticul turist :							: 2
0.20.000			•	υ.			



Table No. 16, Continued

= · · · ·	: P-1	<u>1</u> :	F-2	<u>r-3</u> :	P-4:	P-5	6	Total
Taxation Boonomist		•				:	:	:
Assistant Forest Economist				-	2:	- :		,
Asst. Agl. Econ. (Cron & Livestock Fore-					-	- :	- :	2
casting)-	•	•	7		:	:		
Asst. Agricultural Economist (Land Fco-		•		-		-	- :	1
nomics)	•	•				:		
Asst. Agl. Fcon. (Foreign Competition &				-	- :	-	-	: 1
Demand)	•		9	•	:			
Assoc. Agl. Econ. (Crop & Live stock Fore-					- :	-	- :	: 2
Continuous Branchis				. 1	- :			
Assoc. Agl. Econ. (Farm Management)	· -			1			~	, T
Accord Americal tamed Formericat/Tamed The						_ :	- :	1
nomics)-	•	٠			:		:	
Assoc. Agl. Toon. (Foreign Competition &	· : -	•	-	1	- :	- :	- :	: 1
Demand)					:			
Accor (chatistics) Pass mel	: -		_	1 1	_ :	_ :		1
Assoc. Agl. Econ. (Statistical Research)-		•	_	2	- :	- :	- :	2
Agricultural Economist (Statistical Re-	:	:			1	:	:	
search)-	: -	•	-	-	1:	* •	- :	1
Sr. Agricultural Economist(Land Economics)						1	- :	1
Sr. Agricultural Economist (Marketing)				- :		1	- :	1
Sr. Agricultural Extension Economist					- :	1 ;	- :	1
Prin. Agl. Econ. (For eign Competition & De-					-to-	:	:	
			- :				2:	2
Asst. Warchouse Examiner (Cotton & Bulk)-					- :	- :	- :	3
Asst. Warehouse Examiner (Sack Grain)	-	. :	1	- :	- :		- :	1
Associate Warehouse Examiner	: -	. :	- :		- :	- :	-	1
Asst.Mktg. Specialist (Livestock Market								
Remorter)	÷ -	. :	2	- :	- :	_	_	2
Asst.Mktg.Specialist(Meat Grader)	: _	. :	1 3	- :	- :		- :	1
Asst.Mctg. Specialist(Fruits & Vegetables)	: -	. :	13	→ ;				13
Assoc. Mktg. Specialist (Bean Standardization						- ·		2
Assoc. Mktg. Specialist (Beef Grade Superviso	x) –	. :	_ :		- :	- :	_ :	
Marketing Specialist(Wool)	: -		_ :	_ :	1:			_
Warketing Specialist (Tobacco)	: -	:	_ :	_ :	4			4
Femior Marketing Specialist		:			_ :	1 .		1
Frincipal Marketing Specialist			-		:	_ :	2	
Clericulturist	! _		_	_	1 :		2 :	1
Assistant Toologist			1		_ :	_ ;		1
Assoc. Echlogist (Foreign Plant Introduction		•		, — .	_ :	_ :	- :	1
Associate Pharmacologist	, -		-	1:			- :	1
Seni or Geneticist	: -		- ;	T ;	- :	- :	- :	5
Senior Toxicologist			- :	- :	- :	2:	- :	1
		:	- :	- :	- :	1:	- :	1
Chief of Food Control (Food & Drug Admin-		•	:	:	•	•		,
istration)	· -		- :	- :	- :	- :	1 :	1
	:	:	:	:			:	
	:	:	:	:	:	:	:	
Totals	: 330		88 :	59:	29:	20 :	5:	531
	:	•	:				:	



much to give a clearer idea of the ecology of the original prairies.

Type Specimens of American Grasses in European Herbaria: Professor A. S. Intencock, Bureau of Plant Industry. In order to complete a revision of the North American species of Panicum it was necessary to consult the types deposited in European herbaria. The following list of

collections consulted may be of interest to those who contemplate doing similar work, for the exact location of some of these is not generally known.

Autwerp: Herbarinm of Dr. Van Heurek. Collection of Salzmann from Bahia.

Brussels: Jardin Botanique de l'Etat. Collection of Galeotti from Mexico. Some Fournier types.

Paris: Muséum d'Histoire Naturelle. General herbarium; types of Desvaux, Stendel, Fournier, Richard, Kunth (H.B.K.). Segregated: herbaria of Michanx and of Lamarek; herbarium of Cosson with some Poiret types; and of Drake del Castillo with some Michanx types sent by Richard.

Madrid: Jardin Botánico. Types of Lagasea and Cavanilles.

Florence: Orto Botanico. Types of Poiret (cited in Encyc. Suppl. as "herb. Desfont.").

Padua: Orto Botanico. A collection of Bosc from Carolina.

Geneva: Herbarium. Delessert and the private herbaria of de Candolle and of Barbey (Herb. Boissier).

Munich: Botanisehes Museum. Collection of Martins from Brazil, with types of Nees and Döll.

Vienna: K. K. Naturhistorisches Hofmuseum.

Graz: Private herbarium of Professor Hackel, now at Attersee.

Prague: Collection of Haenke with

Prest's types; part at the Botanical Garden of the German University and part at the Bohemian Natural Museum.

Halle: Botanischer Garten. Professor Mez allowed me to consult the collections of Panicum loaned him by several institutions

Leipzig: Botanischer Garten. No grass types from America.

Göttingen: Botanischer Garten. Types of Grisebach (Wright's Cuban plants and types from Argentina) and of Meyer (Prim. Fl. Esseq.).

Berlin: Botanischer Garten at Dahlem. Types of Link, Spreugel, Kunth, C. Mueller and Nees (Sellow plants from Brazil). The Willdenow herbarium is segregated.

St. Petersburg: Herbarium Trinius at the Imperial Academy of Sciences and the general collection at the Botanical Garden with Fournier's types based on plants of Karwinsky and F. Mueller.

Stockholm: Natural History Museum. Herbarium of Swartz's West Indian plants and the types of Fries and Lindmann from Argentina.

London: Three large collections. Royal Gardens at Kew, with types of Grisebach (Fl. Br. W. I.), Bentham and Pursh. British Museum (Dept. Botany), the collections of Walter and of Sloane, segregated and those of Raddi, Rudge, Robert Brown, and Gronovius. The Linnean herbarium at the rooms of the Linnean Society.

The Bisexual Inflorescence of Humulus lupulus: Dr. W. W. Stockberger, Bureau of Plant Industry.

Humulus lupulus 1. is regarded as a strictly diocious plant, but at rare intervals cultivated forms of the common hop have been observed bearing on the same flowering branches both staminate and pistillate flowers. By several observers these pistillate flowers are regarded only as aborted



forms of the stammate flowers. For several years this phenomenon has been frequently observed by the writer on the Pacific coast. The anthers of the staminate flowers in all the eases examined bore mature pollen grains. The pistillate flowers also were normally constituted. It appears, therefore, that the determinants requisite for the production of gametes of each sex are present in the eells of the plant usually spoken of as female. It is possible that we have here a modification in the habit of the plant produced by the conditions of culture. The inherence of the determinants of each sex in a single plant is further shown in the somewhat rare cases in which a plant reproduces by means of runners. In the wild state and under eertain conditions of culture the underground runners of the hop plant occasionally send up shoots which when mature bear flowers of the opposite sex.

The Possible Rôle of Light in Relation to Alpine Plants: Professor C. H. Shaw, Medico-Chirurgical College, Philadelphia.

Readings with the actinometer and black bulb thermometer in vacuo in the Selkirks seem to prove that, as is commonly believed, light at high altitudes is considerably more intense than on adjacent low-lands and that the difference is chiefly in the refrangible end of the spectrum.

Cultures of plants were made by the writer and Mr. William Moore under experimental conditions. When additional blue-violet light was allowed to fall on plants growing in ordinary daylight, the plants exhibited a distinct structural response. Leaves were more hairy, and internodes shorter than in the control series.

The whole question is therefore open, with the probability that the character of light at high altitudes may have a morphogenic value differing from that at low altitudes.

The Causes of Timber Lines on Mountains; Snow as a Mechanical Agency: Professor C. H. Shaw, Medico-Chirurgical College, Philadelphia.

The phenomena of timber line are not adequately explained by the factors which have been assigned. The timber lines of the White Mountains and Adirondacks can well be referred to the drying action of cold winds, but not so those of the Selkirks. In this case snow, acting as a mechanical agency, plays the chief part. It may do so in two ways:

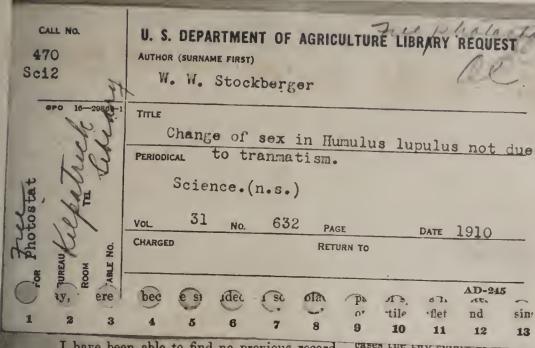
- (a) Small trees are directly broken and abraded by weight of snow or by snow creep.
- (b) Small trees and lower branches which are long held under the late-lying, wet beds of snow, suffer a sort of drowning and become a prey to fungi.

When the struggle of trees for existence is primarily with wind, their height is limited, they grow thickly in level-topped societies, and the upper outposts of the forest are in local depressions or sheltered spots. Wind-cripples have dead or dying tops, often with entire loss of the conical shape; the growth of their branches is limited to a critical line. This leads to a densely branched and often one-sided habit.

On the other hand, when the struggle of trees for existence is primarily with snow, the forest as altitude increases is resolved into groups of trees. These become more separated, and the upper groups of the trees occupy ridges and local elevations. Snow-eripples possess the spire form, with flourishing upper shoots, but the lower branches and foliage are dying or dead, broken by snow and attacked by fungi.

The alpine fields of the Selkirks, which begin at about 6,000 feet, are thus chiefly due to snow. Higher up the characteristic forms of wind-cripples are seen.





I have been able to find no previous record of a sperm whale coming ashore on the Gulf of Mexico. If there are other cases I should be glad to learn of them.

H. H. NEWMAN

AUSTIN, TEXAS

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION G-BOTANY, BOSTON MEETING

As in previous years, Section G held its sessions in alternation with the Botanical Society of America. At Boston a further system of interlocking was made necessary by the program of the newly organized American Phytopathological Society, but it was found by making mutual concessions that conflict of programs could be reduced to a minimum. One joint session was held with the American Phytopathological Society. In the enforced absence of Vice-president Penhallow on account of illness, Dr. B. M. Davis, of Cambridge, was selected vice-president procem. The address of the retiring vice-president, Professor H. M. Richards, entitled "On the Nature of Response to Chemical Stimulation," has been published in full in Science. This address was followed by a symposium on botanical gardens, participated in by William Trelease, N. L. Britton, W. F. Ganong, D. S. Johnson and A. F. Blakeslee; it is expected that this symposium will be published in full in SCIENCE.

The following officers were chosen:

Vice-president-Professor R. A. Harper.

Member of the Council-Professor A. D. Selby. Member of the Sectional Committee (five years) -Professor H. M. Richards.

Member of the General Committee—Professor G. F. Atkinson..

Abstracts of the technical papers follow.

110

XXXI. No. 790

e of the Fertile CHEYSLER.

hological nature æ, derived from iking confirma-Botrychium obire. These bear lace of the northe normal one ar supply of the represent a pair spike represents iflets. In some re fused for part

of their length, and in other cases part of the ordinarily sterile segment is fertile. These facts in connection with other considerations lead to the conclusion that the fertile spike of Botrychium and Ophioglossum represents two fused basal

pinnæ of a fern leaf.

Change of Sex in Humulus Lupulus not due to Traumatism: W. W. STOCKBERGER.

The bisexual inflorescence of Humulus Lupulus L. was the subject of a brief paper read by the writer before the Botanical Society of America at the Chicago meeting in 1907-8. Since that time some experiments have been performed and data from other sources collected which tend to refute the theory that traumatism is the cause of this abnormality. Removal of the tap root, severe pruning, removal of portions of the crown and cutting back the vines after they had attained a length of four to six feet all failed to cause any change in the normal production of the flowers.

Further, the experiments show that a plant which once produces the abnormal type of inflorescence will continue to do so through successive seasons and will transmit this tendency to its asexual progeny. So far as observation goes, it appears that only plants bearing pistillate flowers are subject to reversal of sex. In ar experimental plot of 1,400 seedlings all the plants were apparently normal at first and bore either staminate or pistillate flowers respectively. Later in the summer some of the plants bearing pistil late flowers developed staminate flowers also, Since none of these plants were subjected to the vigorous traumatic treatment described above it is held that some factor other than traumatism produces the sex reversal.

The Taxonomio Value of the Cephalodia in Certain Species of Stereocaulon: LINCOLN W. RIDDLE.

Stereocaulon paschale (L.) Ach. and S. tomen tosum Fr. have been separated hitherto chiefly by



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THE EFFECT OF SOME TOXIC SOLUTIONS ON MITOSIS

WARNER W. STOCKBERGER

(WITH SEVEN TEXT FIGURES)

During the two decades just past there has arisen a considerable body of literature from the researches which have been made upon the physiology of the cell under the influence of various external conditions. The effect of certain stimuli on the growth and form of the organism and the modifications in the normal processes of cell and nuclear division induced thereby have been made the basis of numerous generalizations with respect to cellular activities.

Owing to its bearing upon questions of general and practical interest, the action of toxic substances on the growth of plants has been widely investigated. Notwithstanding this fact, our knowledge of the effect of such substances on cellular development in phanerogams is far from extensive, and the nature of toxicity itself yet lacks a satisfactory explanation. What may be called the modern epoch of the toxicity studies began with the researches of Kahlenberg and True (10), in which the action of chemically equivalent solutions of substances experimented with were for the first time compared.

According to the accounts of a number of writers, various departures from the normal course of nuclear and cell division have been caused experimentally by the action of solutions of various chemical constitution. The technic of this type of investigation was first developed by Gerassimow in the study of the cells of thallophytes, and later adapted to the study of higher forms.

Numerous investigators have studied the action of ether, chloroform, chloral hydrate, potassium nitrate, phenol, benzol, and copper sulfate upon cell processes in certain plants, including Spirogyra, Tradescantia, Phaseolus, Lupinus, Vicia, Pisum, Allium, and Larix. The published accounts of these studies show a general agreement as to the production of certain abnormalities in cell and nuclear development. However, as to the occurrence of amitosis, binucleate cells, fusion nuclei with double the normal number of chromosomes and a heterotypic reducing division in the same, opinions are very conflicting.

Gerassimow (8, 9), Nathanson (16, 17), Pfeffer (24), and Wasielewski (30) found amitotic division of nuclei, but Wisselingh (32, 33), Nemec (22), Andrews (2), and Woycicki (34) saw no cases of amitosis.

Binucleate cells were observed by Gerassimow (8, 9), Nathanson (16, 17), Pfeffer (24), Nemec (18, 20, 21, 22, 23), Blazek (3), Wasielewski (30), Woycicki (34), and Strasburger (29), but they were not found by Wisselingh (31), Andrews (2), and Karpoff (11).

Fusion nuclei were reported by Gerassimow (8, 9), Nemec (20, 21, 22, 23), who found also double the normal number of chromosomes, and by Strasburger (29), but not by the other authors mentioned. The disappearance of the nuclei with the double chromosome number was explained by Nemec (22) as due to a reduction division, in which he is followed by Woycicki (34). This conclusion is severely criticized by Strasburger (29) and by Laibach (12).

From this brief statement of the conflicting opinions advanced in some of the more important papers dealing with the direct effect of various chemical substances upon nuclear and cell division, it is evident that a much wider range of observation and experiment is required before conclusive generalizations can be drawn or the discordant results of the various investigators be brought into harmony. Moreover, in the higher plants the rate and the amount of growth in the seedling stages have been used almost entirely in the measure of the toxic effect, or when such was not the case some microscopic factor has been employed. Apparently there has been little detailed comparative study of the cell and nuclear activities in the higher plants during the course of treatment with an extended series of dilutions of a toxic agent.

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The present investigation was carried out in order to observe the process of nuclear and cell division under certain definite conditions of physiological experiment with a series of toxic substances.

Materials and methods

In this study young seedlings of *Vicia Faba* were used, as they have furnished material for many similar investigations on the physiology of the cell and are well known as suitable material for the study of cellular activities. Uniform series of seedlings selected for the comparative tests were taken from the thoroughly washed sphagnum in which they had germinated, and suspended on glass rods in such a manner that the radicle for about 20^{mm} of its length was immersed in the solution. New nonsol glass beakers of 300^{cc} capacity were used, and a careful distinction was maintained throughout the experiments between those used for the controls and those used for the toxic solutions. This precaution was taken in order to avoid the possibility of the controls being injured by the residuum of copper which, as pointed out by Nägeli (15), is taken up by the glass and may be given off later to contained solutions in quantity sufficient to affect seriously the radicles of plants grown therein.

The radicles were marked with India ink at a point 15^{mm} from the tip just before they were placed in the solution. When not under direct observation, the seedlings were kept in a dark cabinet in the laboratory at a fairly uniform temperature. The agents used were dilutions made from carefully prepared solutions of copper sulfate, strychnin sulfate, and phenol. The controls in the observations on growth rate were grown in distilled water. Either triple distilled water was used or the water was redistilled from glass just before use. Four seedlings were regularly used in each solution and their average growth was taken as the basis of comparison. Except in a few cases, when one or two tips were dead, four tips from each set of seedlings were prepared for microscopical examination.

In preparing the material for microscopical study, various modifications of Flemming's fluids were used in killing and fixing. Dehydration was followed by imbedding in 53° paraffin. The sections were cut $3-5 \mu$ in thickness and stained on the slide with iron-alumhematoxylin, safranin-gentian-violet, or the triple stain. A Zeiss

1.5^{mm} apochromatic objective and compensating oculars were used in studying the preparations.

This investigation was begun in 1904, at the suggestion of Dr. Rodney H. True, to whom I am indebted for constant advice and criticism. I am also under obligations to Dr. G. F. Kluch, who was of great assistance with the seedling cultures.

Experimental

In all work with the radicles which involved measurement of growth, and in the preparation of material for killing and fixing, great precautions were taken to guard against the introduction of undesirable factors, such as loss of moisture, change in temperature, or shock in handling, which might interfere with the results sought.

THE EFFECT OF COPPER SULFATE SOLUTIONS ON GROWTH

Growth and cell activity in the root tips of Vicia Faba upon which copper sulfate solutions of various concentrations had acted continuously were the first subjects of study. Seedlings were placed in a series of solutions with a constant difference of dilution of n/10,000, in order to determine the concentrations in which the toxic effect would not be so strong as to prevent growth to some degree, after allowing time for recovery from the shock due to the change of medium and for partial acclimatization to the toxic substance. Table I shows the average growth of four seedlings in the various concentrations used, and also the growth made by the corresponding controls in distilled water. From the table it is apparent that, in the lower concentrations, the effect of a difference in dilution of n/10,000 is masked by the variability of the individual groups of seedlings, and in the higher dilutions this difference was increased many fold before changes in the growth rate were observed which could be reasonably ascribed to the action of the toxic solution. A comparison of the average growth per hour in the copper solution and in distilled water shows that there is a wide range of toxic effect between the concentrations n/20,000 and n/500,000, with a probable corresponding difference in cell activity, as shown by the slower rate of elongation in the stronger solutions.

TABLE I Comparative growth in CuSO_4 and distilled water during the first day

RAD	OICLES IN COPPER	Controls in distilled water			
Concentration	Time in solutions in hours	Total growth in mm	Average growth per hour in mm	Growth of corresponding control in mm	Average growth per hour in mm
n/20,000	16.5	0.5		8.7	0.52
n/30,000	19.5	0.5		5.0	0.25
n/40,000	19.5 23.5	1.8 1.1	0.01	12.8	0.65
n/50,000	19.5 20.0 21.5	3.0 3.7 3.8	0.15 0.18 0.17	12.8 7.8 11.8	0.65 0.39 0.54
n/60,000	19.5 21.5	4·4 1.8	0.22	7.8 10.2	0.40
n/70,000	19.0 20.0 20.0	8.0 6.0 5.7	0.42 0.30 0.28	12.1 11.0 13.0	0.63 0.55 0.65
п/80,000	18.5 19.0 20.0	4·5 9·2 5·9	0.24 0.48 0.29	11.3 12.1 13.0	0.61 0.63 0.65
n/90,000	18.5 19.0 20.0	5.I 9.7 5.4	0.26 0.51 0.27	11.3 12.1 13.0	0.61 0.63 0.65
n/100,000	18.5 19.0 20.0	7.0 11.2 8.3	0.37 0.58 0.41	11.3 12.1 13.0	0.61 0.63 0.65
n/110,000	18.5 21.5 24.0	7.0 6.5 8.5	0.37 0.30 0.35	11.3 14.6 14.3	0.61 0.67 0.59
n/120,000	21.5 24.0	6.8 9·5	0.31	14.6 14.3	. 0.67
n/130,000	21.5 24.0	8.o 12.3	0.37	14.6 14.3	0.67
n/140,000	2I.O 24.O	5.0	0.23	8.3 16.0	0.39
n/150,000	2I.O 22.O	6.5	0.30	8.3 16.5	0.39 0.75
<i>n</i> /160,000	24.0	12.8	0.53	16.0	0.66
n/250,000	19.0	11.5 8.8	0.60	14.2	0.74 0.54

TABLE I—Continued

RAD	ICLES IN COPPER	CONTROLS IN DISTILLED WATER			
Concentration	Time in solutions in hours	Total growth in mm	Average growth per hour in mm	Growth of corresponding control in mm	Average growth per hour in mm
n/275,000	19.0	11.8	0.61	14.2	0.74
	19.0	11.0	0.57	10.3	0.54
	18.0	7.8	0.42	15.0	0.83
n/300,000	19.0	11.2	0.58	14.2	0.74
	19.0	10.3	0.54	11.5	0.60
	19.0	14.0	0.71	10.3	0.54
	18.0	6.0	0.33	15.0	0.83
n/400,000	19.0	10.0	0.52	11.5	0.60
	18.0	12.7	0.70	15.0	0.83
	24.0	14.8	0.61	15.8	0.65
11/500,000	18.0	16.0	0.88	15.0	0.83
	24.0	13.7	0.57	15.8	0.65

Observations were next made on the growth rate to ascertain whether the retardation occasioned a gradually increasing lag in rate of elongation, or an abrupt termination of growth due perhaps to the sudden failure of vitality in the cell. Table II shows the average growth of several groups of four radicles, each selected from the various concentrations, and of the corresponding controls in distilled water. The several growth periods recorded for each concentration were consecutive.

With one exception, growth was in every case less in the copper sulfate solution than that made by the control in distilled water. In the higher concentrations growth was practically inhibited at the end of a twenty-four hour period. Passing down the series the growth is seen to be gradually diminished after the first twenty-four hours. A similar reduction in growth rate is apparent in the controls, though in a degree much less marked.

The observations summarized in tables I and II indicated that the series of concentrations selected would afford material showing strong toxic action resulting ultimately in death (n/20,000 to n/50,000), as well as the more prolonged and gradual though no less fatal effect of higher dilutions.

TABLE II

AVERAGE GROWTH IN COPPER SULFATE SOLUTIONS AND DISTILLED WATER*

Сог	PPER SULFATE SOLUTION		DISTILLED WATER	
Concentration	Time in solution in hours	Growth in mm	Growth of corresponding control in mm	
n/50,000	21.5	2.3	10.2	
	24.5	0.0	8.0	
	49.0	0.0	11.6	
n/90,000	20.0	4.5	II.O	
	24.0	1.2	12.3	
n/110,000	18.5	7.0	11.3	
	25.0	2.0	11.7	
	22.5	0.5	9.7	
n/150,000	21.0	6.5	8.3	
, , ,	22.0	4.0	10.2	
	24.0	0.7	10.2	
n/250,000	10.0	11.5	14.2	
	24.0	9.2	14.0	
	24.0	3 · 7	II.2	
n/300,000	10.0	II.2	14.2	
	24.0	5 · 7	14.0	
	24.0	0.5	11.2	
n/400,000	18.0	12.7	15.0	
	24.0	10.5	13.0	
	24.0	4.2	10.0	
n/500,000	18.c	16.0	15.0	
	24.0	15.2	13.0	
-1	24.0	7.2	10.0	
n/500,000	24.0	13.7	17.2	
	24.0	7.5	14.7	
	24.0	1.5	2.7	
	24.0	0.5	3.0	

^{*}The intervals under each concentration represent consecutive periods of exposure for a single group of seedlings. The sum of these intervals will give the total time in the solution.

THE EFFECT OF DILUTE SOLUTIONS OF COPPER SULFATE ON MITOSIS

The material discussed in this section was selected from cultures in various concentrations of copper sulfate, and the root tips chosen for study, together with the corresponding control in distilled water, were fixed in the manner noted above at intervals of approximately twenty-four hours. Some preparations were made at other intervals in order to increase the range of observations.

In root tips fixed after an exposure of one hour to n/20.000, mitosis was arrested; after 16 hours the root tips were dead. After 20 hours in n/30.000 there were no mitoses, and the cells of the dermatogen, outer periblem, and meristem were dead and disintegrating. The nuclei of the cells not disorganized were of normal size and occasionally contained two nucleoli.

After exposure for 40 hours to n/40,000 there were only rare mitoses. The outer cell layers were plasmolyzed, the mid-plerome cells were vacuolate, and the persistent nuclei shriveled. The nuclei of the larger number of the other cells of the plerome were resting and very frequently contained two nucleoli. The apex of the tip was dead, but some development in the plerome region was evidenced by the thickened walls of the cells destined to form the fibrovascular bundle. These thickened cells extended down to within 2^{mm} of the end of the radicle. At 3^{mm} from the apex of the tip there was an area of hypertrophied periblem cells (fig. 1) which had developed to several times the normal size, producing distortion of the radicle and giving it a swollen edematous appearance on one side. Since the nuclei in these cells were disorganized, a corresponding increase in size could not be determined.

In tips exposed for 6 hours to n/50,000 there were a few division figures. An exposure of 20 hours to this concentration killed all the cells in the meristem region. Many of the middle periblem cells were greatly enlarged, and in the others practically all nuclei were in the resting stage and were rich in chromatin. Cells with two nucleoli were very common in the plerome region, where also a few cells were observed containing three nucleoli. In general appearance the plerome cells resembled those shown in $fig.\ 2b$. After 44 hours practically all the cells were dead and disintegrating.

An exposure of 20 hours to n/70,000 killed the outer layers of cells, but in the inner periblem normal chromatic figures were present, and as in the preceding cases the achromatic figures were obscure. At the end of 46 hours large vacuoles appeared in the cytoplasm of many cells, and frequently so crowded upon the nucleus that it was driven to one side of the cell. Nearly all of these cells were enlarged in size and irregular in outline. In the inner periblem practically all stages of the chromatic figure occurred, although very few cells

contained other than resting nuclei. After 69 hours' exposure to this concentration the older periblem cells were still more enlarged and the outer ones were disintegrating. A few of the inner periblem cells showed division stages, none of which were later than early anaphase.

The cells of the root tips treated with n/190,000 for 44 hours differed little from those in n/70,000 for the same length of time.

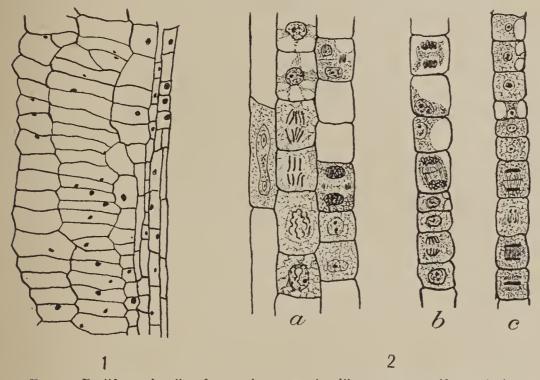


FIG. 1. Proliferated cells of root tip grown in dilute copper sulfate solution.—FIG. 2. a, cells of root tip of *Vicia Faba* after 96 hours in distilled water; b, the same after 46 hours; c, *Lupinus albus* 69 hours in distilled water.

After 72 hours there was no division, and the periblem cells were frequently enlarged.

In the outer periblem of the material treated with n/100,000 for 43 hours, a few cells occurred containing division figures. In the inner periblem many nuclei were in the spireme stage and the meristem area was especially active. In these inner cells the achromatic figure appeared to be normally developed, but in the outer layers the cells were more or less vacuolized, and the spindle fibers were degenerating. In 93 hours this condition had spread to all the cells.

Approximately similar conditions occurred in the radicles treated in the concentrations n/140,000 and n/150,000. In 93 hours prac-

tically all cells were dead, the outer layers being also disorganized. However, in the case of the material in n/150,000 for 93 hours, in the periblem cells about 3^{mm} from the apex of the root tip a few mitotic figures occurred. In the corresponding controls in distilled water, chromatic figures were frequent even in the outer periblem cells, but many abnormalities occurred in the achromatic figures and cytoplasm (fig. 2b). Nuclear division occurred here and there in the inner periblem of tips which had been 93 hours in a n/160,000 solution, but the outer periblem was dead and disorganized. The division figures did not differ from those in the controls, and the nuclei in the resting stage were normal in appearance. In tips exposed for 68 hours to the action of n/300,000, n/400,000, and n/500,000 solutions, division was frequent in all parts of the active tissue and did not differ essentially from that in the corresponding controls. However, the outer cell layers of the tips in the copper solutions were less active, and the total number of mitoses was smaller than in the controls. The cytoplasm of many cells contained vacuoles of variable size, some being so large as to crowd heavily upon the nucleus. The same phenomenon occurred, though less frequently, in the controls.

Demoor (7), who studied the effect of chloroform on the cell protoplasm, observed therein a marked vacuolization which he regarded as the direct result of the action of this reagent. Also Nemec (18) found that chloroform and potassium nitrate produced vacuoles in both chromosomes and cytoplasm of *Vicia Faba*, and Blazek (3) states that benzol vapor caused the vacuoles of the cytoplasm so to increase in size that they caused deformation of the nuclei. However, since vacuoles, similar to those observed in the course of these experiments with copper sulfate, occurred also in the controls in distilled water, it would appear to follow that this phenomenon is not necessarily due to a narcotic or poisonous action, but may result from an alteration in the concentration of the cell fluids.

Before the examination of the toxicated material had proceeded very far, it became evident that the conditions of mitosis in the controls grown in distilled water were far from normal. The entire series of controls was thereupon reexamined, and a progressive degeneration demonstrated therein closely resembling that in the cells treated with [010]

the copper solutions. After 7 hours in distilled water there was little division in the periblem, the figure in a few cells being in early prophase. Division was active in the plerome. After 22 hours division had ceased in the outer layers, but still occurred normally in the inner tissues. In 46 hours the radicles were curved, numerous cells were dead, large vacuoles occurred in the cytoplasm, and in many cells the achromatic figure was degenerating (fig. 2b). The general condition after 96 hours is illustrated in fig. 2a. Particularly striking are the large nuclei, the cytoplasmic vacuoles, and the interrupted cell plate seen in one of the upper cells of the figure. Fig. 2c represents a group of cells from a radicle of Lupinus albus after 46 hours' exposure to distilled water, and is inserted here for the purpose of comparison. In these cells also vacuoles occurred in the cytoplasm, and there was some degeneration of cytoplasmic structure.

It appears that the distilled water exerted practically the same effect on mitosis as was produced by the dilute copper sulfate solutions, but only after a more prolonged exposure.

THE EFFECT OF MORE CONCENTRATED SOLUTIONS OF COPPER SULFATE

In planning the experiments with stronger solutions of copper sulfate, some paragraphs from Nemec's "Ueber ungeschlechtliche Kernverschmelzungen" (21) were held in mind. In this paper NEMEC describes the production of binucleate cells and other abnormalities by placing the radicles of Vicia Faba for thirty minutes in I per cent solution of copper sulfate and then transferring them to moist sawdust for seven hours. Nemec's experiment seemed to indicate that Vicia Faba was remarkably resistant to the action of copper solutions, indeed to a far greater degree than in Lupinus albus, in which, as was learned through access to some unpublished notes of Dr. R. H. True, some growth can occur after an exposure of eight minutes' duration to a n/16 solution of copper sulfate. A test quickly showed that thirty minutes' exposure to a 1 per cent copper sulfate solution (approximately n/12) was fatal to the material being used in these experiments. A series of preliminary experiments was carried out, therefore, to establish approximately the time limit which would just permit growth in n/4 and n/12 solutions as boundary concentrations, with results indicating that a slight amount of growth would follow exposure to a n/4 solution for three minutes, and that seven minutes' exposure to the n/12 solution, while permitting some growth, was not far from the point of killing.

For the experimental work the solution n/12 was chiefly relied upon as being best suited to give a sharp toxic effect, without endangering the loss of the material through death. The radicles were exposed to this solution for periods of three and seven minutes, respectively, were then rinsed quickly in distilled water, and at once transferred to the medium in which they were kept until the time for killing and fixing. Another dilution and longer interval of exposure were also employed to furnish a broader basis for observation.

In order to have at hand for constant comparison material grown under parallel conditions with the toxicated radicles, except for the treatment with the copper sulfate solutions, a uniform lot of seedlings was taken from the germinating chamber, selected to approximately the same size, and divided into six groups which were then prepared as follows: (a) one group in moist sphagnum; (b) one in distilled water; (c) one in n/12 copper sulfate three minutes, then sphagnum; (d) one in n/12 copper sulfate three minutes, then distilled water; (e) one in n/12 copper sulfate seven minutes, then sphagnum; (f) one in n/320 copper sulfate ten minutes, then distilled water.

Four root tips were fixed from each series at intervals of 3, 7, 22, and 30 hours. Sections of the tips from the first two series, designated as the controls in the following pages, were compared at every stage with the sections studied in the remaining series.

The cell growth and nuclear division observed in the controls placed in sphagnum were considered as normal, since good preparations were secured showing abundant mitoses, all of which conformed to the type generally reported as occurring in vegetative tissues of Vicia Faba (fig. 6). Departures from the normal cell division were observed in the controls grown in distilled water similar to those observed in the controls paralleling the cultures in dilute copper sulfate solutions (figs. 2a, 2b). Since the radicles in the copper sulfate solutions were manipulated under conditions identical with those obtaining in the controls, except for the exposure to the toxic solution,

marked discrepancies in nuclear behavior, it was believed, could safely be regarded as a result of toxic action.

Root tips which were exposed to n/12 copper sulfate solution for three minutes and then transferred to distilled water for three hours showed the effect of strong toxic action in the peripheral cell layers. Here the cells were dead, but in the inner periblem occasional nuclei were in division, but frequently the cell plate had failed to form (fig. 3). In the majority of the uninjured cells the nuclei were in the typical resting stage. In no case did nuclei which were in the spireme stage show the hyaline polar caps, frequently figured as characteristic of the development of the normal achromatic figure in Vicia Faba, and occurring in the controls grown in sphagnum in these experiments (fig. 6). The nucleoli were usually large and frequently occupied a clear area surrounded by the linin network, as seen in fig. 3. Many nuclei contained two large nucleoli, each lying within a distinct clear area. In the degenerating nuclei of the injured cells the persistent nucleolus was generally of very large size, and the form of the nucleus was usually outlined only by the linin network, all chromatic substances other than the nucleolus having lost their usual staining properties. In some cells the cytoplasm showed modifications apparently due to the action of the copper sulfate, although these were usually not sharply defined, but in some cases numerous large vacuoles occurred distributed through the cytoplasm, in others huge vacuoles had formed at the sides of the nucleolus, presenting much the appearance of the older cells in which large sap cavities had formed.

In root tips which had been exposed for three minutes to n/12 copper sulfate solution and then placed in water for seven hours, the cells presented much the same general appearance as those examined at the end of the three-hour period. The greater part of the nuclei were in the resting stage, though a few cells of the inner periblem showed spiremes forming. Occasional nuclei were farther advanced in division, but no stage later than middle anaphase was seen. In the distribution of the chromosomes, and in their manner of passing from the nuclear plate, no deviation from the typical process occurring in the controls in sphagnum was observed. After 22 hours a decided change in the appearance of the cells of the root

tip was apparent. The dermatogen had exfoliated and the periblem cells, having lost their normal rectangular form, were irregularly rounded. All early stages of mitosis were present, and the development of the chromosomes had proceeded normally. All stages of

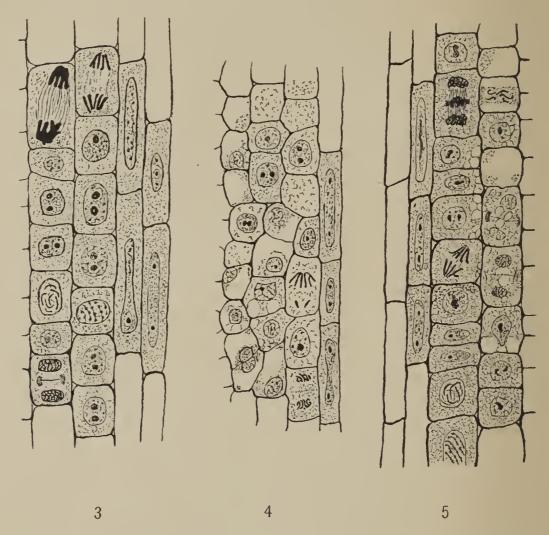


Fig. 3. Vicia Faba three minutes in n/12 copper sulfate, then three hours in distilled water.—Fig. 4. Vicia Faba three minutes in n/12 copper sulfate, then twenty hours in distilled water.—Fig. 5. Vicia Faba seven minutes in n/12 copper sulfate, then three hours in distilled water.

mitosis up to the formation of the cell plate occurred, but with frequent degeneration of the spindle fibers (fig. 4). The newly formed division walls separating certain cells were very thin and indistinct, and the appearance presented on first examination suggested the binucleate cells described by Nemec (22) and others. These division walls were usually asymmetric with the other cell walls. In

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the root tips examined after 30 hours, division still occurred in the periblem cells. The chromatic figure was regularly found, but only in the inmost layers of cells was the spindle unaffected. The nuclear plate had formed in the central spindle region of most cells, but usually failed to reach the walls.

In the root tips placed in distilled water for three hours after seven minutes' exposure to n/12 copper sulfate, very few mitoses occurred in the periblem cells, but in these the chromatic figure presented a normal appearance. The cytoplasm of all the outer periblem cells exhibited large vacuoles, some of which had enlarged sufficiently to drive the nucleus to one side of the cell, and in the inner periblem frequent cells developed unusual vacuoles. In some cells in late anaphase vacuoles occurred between the cell plate and the daughter nuclei (fig. 5), a condition which occurred also in the distilled water controls, but division did not proceed farther in the copper solution. At one side of some cells the plate, failing to reach the lateral wall, ended in a fibrous plasma mass about half-way between the axis of the spindle and the wall of the cell. In the cells at the apex of the root tip occasional nuclei were in early prophase, anaphase was frequent, and a few nuclei were at telophase. In the latter stage the cell plate had formed in the normal manner, but in practically all the nuclei at anaphase no trace of cell plate appeared. In some cells the spindle fibers were only faintly visible, in others a perceptible thickening of the fibers had occurred in the equator of the spindle, but no figure showed the line of granules characteristic of cell plate formation. In the resting nuclei, as usual, there occurred one or two large nucleoli. These were rarely circular as viewed in optical section, but were amoeboid in form.

In radicles placed for ten minutes in n/320 copper sulfate, then transferred to distilled water for three hours, the dermatogen cells were dead and many of the outer periblem cells lacked nuclei. The nuclei present were in the resting stage. Numerous mitoses occurred in the cells of the plerome and inner periblem, but the larger number showed a tendency toward degeneration in the spindle fibers. After seven hours the general appearance of the cells was much the same, but there were very few mitoses. After 22 and 30 hours, respectively, no division figures occurred in the outer cell layers, but a few cells

in the periblem and inner plerome still showed normal chromatic figures; some nuclei were in the spireme stage, although the majority were resting; cellular activity, as expressed in division, had practically ceased.

A comparative estimate of the proportion of cells in course of division in each of the several experiments did not show that any concentration used had stimulated division; on the contrary, the retarding influences, particularly in the more concentrated solutions, were very pronounced. The first apparent effect of the toxic solution was arrest of nuclear division through inhibition of the activities of the achromatic figure. In the early division stages this was soon followed by degeneration of the spindle fibers. In the later stages of division the failure of cell plate formation was characteristic. These phenomena were accompanied or followed by an increase in the number and size of the vacuoles in the cytoplasm. The death of the cell evidently occurred shortly after this condition was reached.

It seems probable that the toxic solution penetrates somewhat slowly to the inner cell layers, since under its influence the outer layers of cells are killed, while in the inner regions not yet visibly affected, normal development continues.

There was no satisfactory evidence of the occurrence of amitosis. Double nucleoli occurred as frequently in the cells of the controls as in those treated with the copper solutions, a result which, so far as these experiments have extended, directly controverts the statement of Wasielewski (30) that "das erste Kennzeichen, dass ein Kern sich zur amitotischen Theilung anschickt, besteht in einer Verdoppelung des Nucleolus."

The copper solutions did not cause abnormalities in the development of the chromatic figure. There was no doubling of the normal number of chromosomes. Occasionally two daughter chromosomes remained attached by their ends for some time after the others had left the nuclear plate, apparently forming an attachment between the daughter chromosome groups. However, this irregularity was also observed in the controls. Nemec (21) states that treatment with 1 per cent copper sulfate solution produced binucleate cells in root tips of *Vicia Faba*. After 17 hours' sojourn under normal conditions binucleate cells no longer appeared, and he concluded, therefore, that

the nuclei in the binucleate cells had fused. The experiments here described furnish no support to this theory of nuclear fusion, since no cells were observed that contained more than one nucleus. Occasionally, through failure of the nuclear plate, cells appeared to contain two nuclei, but these daughter nuclei were never fully reconstituted, and the cells were degenerating.

The stronger copper solutions inhibited mitosis, disorganized the spindle fibers or interrupted their formation, arrested the development of the cell plate, and produced large vacuoles in the cytoplasm. The same effects were produced in the controls in distilled water, though to a less marked degree, and after a longer period of exposure. There were no abnormalities in the controls grown in sphagnum.

THE ACTION OF PHENOL

In studying the action of phenol a normal solution was prepared, and various dilutions were made therefrom in the course of the experiment. Controls were grown in moist sphagnum and in distilled water. The continuous action of phenol was observed in n/94 and n/188 solutions, respectively. Solutions of 10/94, 5/94, and 1/188 normal were allowed to act on radicles for 20 minutes, after which they were placed in distilled water and material killed and fixed therefrom at intervals of 4, 21, and 45 hours. Material from the controls received parallel preparation. In the microscopical examination of the toxicated root tips no unusual structure or condition was considered as due to the action of the phenol until careful search had shown that its equivalent did not exist in the controls.

The continuous action of a n/94 solution of phenol for four hours seriously injured both the cytoplasm, which showed numerous small vacuoles, and the achromatic portion of the nucleus. Numerous spireme nuclei were observed, many of which were much enlarged and irregularly distended apparently by a great increase in the amount of nuclear sap within them. Occasionally these enlarged spireme nuclei were laterally indented by the formation of a dense plasma mass at one side (fig. 7a). These nuclei very much resembled those described by Nemec (22) as formed under the influence of chloral, of which he says: "In einiger Zellen giebt es mehr oder weniger tief eingeschnürte Kerne." At this point the resemblance ceases, and no support can

be given to Nemec's further statement that "diese Zellen können Scheidewandanlage besitzen." Since no other unusual forms were observed in either cell or nucleus, these are regarded as nuclei in the course of disorganization. In the older as well as in the younger portions of the root tip nuclear figures occurred which usually showed

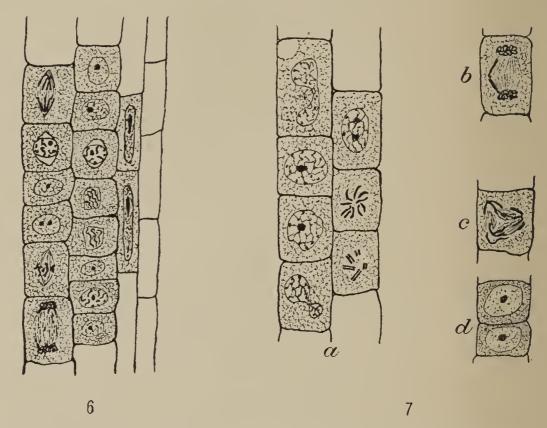


Fig. 6. Normal cells from a root tip of $Vicia\ Faba$ grown in moist sphagnum.— Fig. 7. a, $Vicia\ Faba$ in n/94 phenol four hours; b, retarded separation to chromosomes; c, multipolar spindle; d, enlarged nuclear areas.

the achromatic spindle or its remnants. However, no division stage later than very early anaphase was present. The chromosomes in part of these figures had split longitudinally, in others no splitting occurred. In no case had the chromosomes left the nuclear plate. Evidently the movement of the daughter chromosomes from the nuclear plate to the poles of the spindle had here been inhibited by the action of the phenol upon the mantle fibers.

At the end of 21 hours the root tips had a dull white luster, and were evidently dead. Upon examination all the cells were found to be plasmolyzed.

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The radicles which had been for four hours in n/188 phenol were next examined and all stages of mitosis found. The cytoplasm of the cells of the outer layers exhibited a coarsely netted structure due to the formation of numerous small vacuoles. Occasional spireme nuclei were unduly enlarged, and in a very few cases the nuclei were constricted in one diameter, apparently by the development of a plasma mass as previously noted. The early stages of the spindle were very obscure, but during anaphase the fibers became quite distinct. A few cases of late anaphase occurred in which occasional chromosomes had not left the nuclear plate, but remained at one side of the spindle in line with the row of granules marking the early stages of cell plate formation (fig. 7b). A similar occurrence was observed by Blazek (3) in the cells of root tips of Pisum treated with benzol, and in Vicia Faba also by Schrammen (27), who says: "Eine nicht seltene Erscheinung bei der plötzlichen Einwirkung von hohen Temperaturen ist das Nichterfassen von Chromosomen durch die Spindelfasern und das Zurückbleiben einzelner Chromosomen bei dem raschen Transport zu den Spindelpolen." In a few cases the chromosomes at one pole of a spindle had diverged and formed two groups, to each of which a portion of the spindle extended (fig. 7c). Sabline (26), who produced similar phenomena by the use of sulfate of quinine, says, "Sur quelques figures multipolaires on peut voir deux et quelquefois trois fuseaux." In the material treated with phenol, however, multipolar spindles occur so rarely that there seems to be no good ground for assuming that they are produced by the action of this reagent.

After an interval of 21 hours in n/188 phenol there were no mitoses. The nuclei were all in the resting stage and for the most part contained but a single nucleolus. General disorganization of the cells of the root tips had begun.

Tips of radicles were treated for 20 minutes with 10/94 normal phenol and then transferred to distilled water for four hours. At the end of this time all nuclear activity had ceased. In most cases the nucleus was enlarged, and in the field of the microscope appeared as a light area against the darker background of the cytoplasm of the cell (fig. 7d). The chromatin had almost entirely disappeared from the nuclear network. Very prominent in the nucleus appeared

one or two large and deeply staining nucleoli. After 24 hours under similar conditions there was little change in the appearance of the cells. Plasmolysis in occasional cells and the collapsed walls of the outer cell layer indicated that disorganization had begun.

Next 5/94 normal phenol was allowed to act for 20 minutes on root tips, which were then transferred to distilled water for four hours. There were no mitoses. In certain cells of the inner periblem and in some plerome cells elongating to form procambium, large vacuoles occurred, while many enlarged nuclei had partially collapsed. general condition of the cells resembled very closely that obtaining after the exposure for four hours to the 10/04 normal solution. 21 hours the root tips had made no further growth and were evidently dead. Disorganization of the cell structures, however, had not progressed so far as in the case of the material with 10/04 normal for the same time. Here again the nuclear area was enlarged, though very regular in form, and had a lighter hue than the surrounding cytoplasm. In the radicles treated for 20 minutes in the other dilutions employed, continuous growth occurred and development was apparently normal. After 20 minutes' treatment with n/94 and n/188 phenol, respectively, and then with distilled water for 45 hours, the root tips were fresh and crisp and had elongated at approximately the same rate as the distilled water controls. Mitoses were frequent, and the more active regions of the cytoplasm, particularly the achromatic figure, showed no injury as a result of the action of the phenol.

Phenol in common with most antiseptics is a marked protoplasmic poison. Certain results of its action were especially apparent in the cells of the root tips treated continuously with this reagent. The achromatic figure of the division nucleus in early anaphase was seriously injured and mitosis inhibited. The nuclear plate stage was apparently unusually sensitive to the action of the phenol, since the spindle fibers as a rule failed to function normally in drawing apart the daughter chromosomes. As previously noted, the development of small vacuoles in the cytoplasm appears to be a characteristic effect produced by the phenol. There was no amitotic division and no tendency toward the production of binucleate cells was observed.

In the material treated for 20 minutes with the stronger solutions and then with distilled water, the most striking modification was the

enlarged nuclear area surrounded by cytoplasm of a darker hue. Here also the cytoplasm usually contained small vacuoles, but neither amitosis nor abnormal division figures occurred. The general course of events under the action of the phenol seems to be the progressive decline of the cell functions, beginning in the most active and labile regions of the cytoplasm. The visible form changes are confined almost entirely to the enlargement of the nuclear area and the formation of numerous small vacuoles in the cytoplasm. The abnormalities due to the action of phenol are clearly differentiated from those occurring in the distilled water controls as previously described. The sphagnum controls were normal as usual.

THE EFFECT OF STRYCHNIN SULFATE

The preparation of the solution of strychnin sulfate and the manipulation of the material accorded closely with the plan pursued with the phenol. Five strengths of solution were used, which for convenience in comparison are expressed approximately in terms of percentage solutions, viz., 1, 0.5, 0.25, 0.1, and 0.01 per cent. In the first group of experiments the radicles were exposed to the constant action of the several solutions for intervals of 3, 6, and 24 hours. In the second group the root tips were treated with the various dilutions for ten minutes, and were then transferred to distilled water for the time intervals mentioned above. The usual controls were carried in sphagnum and in distilled water.

The r per cent solution was allowed to act on radicles for three hours. The tips were then a dull white color and had become flaccid. The cells were all plasmolyzed, and in the outer layers they were disintegrating.

From the external appearance after three hours' immersion in the 0.5 per cent solution death was inferred. However, in plerome and inner periblem a few nuclei were dividing. The outer cells were plasmolyzed and the cell walls were breaking down. In the inner cells the few scattered spireme nuclei and chromatic figures retained their normal shape and orientation in the presence of large vacuoles, one or more of which frequently occurred in the cytoplasm of these cells.

After three hours in the 0.25 per cent solution there were no mitoses.

The cytoplasm of many cells was plasmolyzed, while that of others exhibited a coarse web or net structure, but the cells themselves retained their shape and the outer layers were not disintegrated.

In the tips of radicles acted on by a o.1 per cent solution for three hours all stages of division were observed. The achromatic figures were very distinct, and nuclei with two nucleoli occurred frequently. After six hours in this concentration the cells of the outer layers were dead and the cell walls had collapsed. There were some spireme nuclei in the inner periblem and a few nuclei were at anaphase. The large deeply staining nucleoli were prominent features of all nuclei not disorganized.

The cells of the outer layers of root tips in o.or per cent strychnin for three hours were mostly dead and collapsed. Division figures occurred occasionally in the plerome and were frequent in the inner periblem cells. The spindle fibers of anaphase were clear and distinct, but no polar caps were observed in spireme nuclei. The cell plate was regularly laid down in late anaphase and two nucleoli were frequent in resting nuclei. After five hours in the o.o. per cent solution some division figures were present. The number of spireme nuclei in proportion to those in the later division stages was greater than at the end of three hours. Very few nuclei were in late anaphase. After 20 hours the area of dead cells included all but those of the inner periblem at some distance from the apex of the tip. No deformation of the nuclei occurred. Even in cells in which the cytoplasm was disorganized, the nuclei frequently retained their normal shape and general appearance. Growth and nuclear activity seemed to have been arrested by the gradual failure of cytoplasmic activity.

The radicles exposed for ten minutes to the strychnin solutions, then transferred to distilled water, were next considered. After ten minutes in 1 per cent solution and three hours in water the cells of the outer layer were dead. In many of the plerome and inner periblem cells containing division figures the cytoplasm was vacuolate, but the figures were not disturbed. All stages of division were observed, but there were no aberrant mitoses.

After six hours in this concentration further disintegration of the outer cells had taken place. Normal division figures persisted in the plerome and inner periblem cells, and a few rare spireme nuclei

showed clearly the polar caps. There were no abnormal structures. At the end of 24 hours there were no mitoses, all the cells were evidently dead.

In the tips exposed for ten minutes to the 0.5 per cent solution, and then placed in distilled water for three hours, mitotic figures occurred even in the outer cells of the periblem. The cytoplasm of these cells usually contained several large vacuoles and the nuclei were all normal in appearance. All stages of normal mitosis were abundant. After 6 hours little change in appearance was visible, but after 24 hours the cells of the outer layers were dead. However, all stages of normal division were abundant in the plerome and inner periblem.

Normal mitoses were abundant in the tips of radicles placed in the 0.25, 0.1, and 0.01 per cent strychnin solution for ten minutes, then in distilled water for 3, 6, and 24 hours. There was no evidence that the strychnin solution had exerted any harmful action in the last three concentrations, during ten minutes' exposure.

The data on the effects of strychnin on higher plants are not very extensive. According to Pfeffer (25), it has not been satisfactorily determined that alkaloids affect the protoplasm of plants. In his discussion of the effects of alkaloids in general, Czapek (5) says: "Für höhere Pflanzen stellte schon Knop an Mais fest, dass Chinin, Cinchonin, Morphin schädlich wirken, und auch hier gehören Chinin, Strychnin, Cocain zu den giftigsten Substanzen, während Morphin relativ schwach einwirkt (Marcacci)." Mosso (14) found that 0.05 per cent solutions of strychnin stimulated germination in *Phaseolus multiflorus*, but that more concentrated solutions retarded it. Davenport (6) states that the protoplasm in the tentacles of Drosera is killed by the action of strychnin. He mentions also its retarding action on the germination of peas, corn, and lupines, but unfortunately the concentrations which exerted a harmful action were not given.

The action of alkaloids on Protozoa has been investigated by Schürmayer (28) and others, with results that apparently confirm the theory advanced by Loew (13) that the action of alkaloids is mainly confined to the plasma of the ganglion cells. Clark (4) found that species of fungi, notably Sterigmatocystis, as well as Aspergillus and Oedocephalum, grew and fruited in a saturated solution of strychnin sulfate. Clark finds that his studies on the molds harmonize with the

theory of Loew, and concludes that the fungi and bacteria are practically unharmed by this alkaloid, since they have no differentiation of nerve protoplasm. This line of reasoning carried logically forward would argue for the presence of protoplasmic structure in the higher plants which should be comparable with the nerve fibers of animals. Such structures have indeed been described by NEMEC (19) from root tips of Allium and Vicia Faba. In the latter plant the longitudinal protoplasmic strands of the large plerome cells of the root are regarded by NEMEC as bundles of fibrillae surrounded by a definite sheath and lying imbedded in a special plasma. Nemec concludes that these fibrils are strands of protoplasm specialized for the conduction of traumatropic, geotropic, and other stimuli, and compares them, although with little apparent warrant, to the nerve fibers of animals. Since the protoplasm often develops a fibrillar structure in connection with other functions, it is not certain that the systems of fibrillae observed by Nemec are specially adapted for the transmission of these stimuli, and therefore the portion of the protoplasm peculiarly sensitive to the action of alkaloids. Andrews (I) found that many marine plants, including Cladophora, Ectocarpus, and Polysiphonia, were uninjured by a solution of strychnin sulfate having one part in 1000 of water, but that a solution of the same having one part in 250 killed all the plants in 24 hours.

Although the experiments carried out with strychnin sulfate on Vicia Faba were far from satisfactory, they indicate clearly that this reagent is an active poison to the plant used. The cytoplasm first becomes vacuolate, and then degenerates in the outer cell layers, and this condition progresses toward the center of the root tip as the time of exposure to the strychnin solution is extended. It is planned to pursue this line of experimentation farther, in order to determine whether this reagent produces definite and characteristic form changes in the protoplasm.

Summary and conclusions

The cell studies here described were made in the hope of obtaining some further data on the physiology of toxic action. The work which has been done in this direction seems to be concerned more with the production and study of abnormal cell phenomena than with the com-

parison of cell activities under a series of abnormal conditions varying in intensity. It is well known that in a series of dilutions of a toxic substance growth diminishes usually as the concentration increases, and the end sought in these studies was to contrast cell activities under such abnormal conditions of development. No deliberate attempt was made to induce abnormal cell behavior.

The toxic solutions experimented with were (1) copper sulfate, a metallic base which readily ionizes; (2) phenol, a non-electrolyte; and (3) strychnin, an alkaloid presumably poisonous to protoplasm. First the rate of growth of radicles of Vicia Faba was determined in a series of concentrations of copper sulfate ranging from n/20,000to n/500,000, then the number of hours required for growth to be reduced to the minimum was next observed in order to determine the range within which to choose material for study. Root tips grown in the above and intervening concentrations were examined at intervals ranging from 1 to 93 hours. Radicles were also subjected to the action of stronger solutions, n/12, n/320, for intervals of 3 to 10 minutes, and the cells were examined after a lapse of 3 to 30 hours. The results indicate that the toxic effect was first felt in the kinoplasm of dividing cells, as shown by the loss of function and subsequent degeneration of the achromatic figure. Large vacuoles arose in the cytoplasm, frequently deforming achromatic figure and nucleus. Later the entire cytoplasm was disorganized. Development of the chromatic figure was consequently inhibited, but neither amitosis nor abnormal mitosis was observed. In the controls in distilled water, also, the cytoplasm became vacuolate; some of the nuclei were enlarged, and occasionally the formation of the cell plate was interrupted. In both copper sulfate solutions and distilled water the course of events was arrest of mitosis by loss of functions in the achromatic figure, followed by the death and disorganization of the cell contents.

The treatment of root tips with solutions of phenol ranging from n/188 to 10/94 normal produced enlarged achromatic figures and caused the cytoplasm to become very coarsely netted or vacuolate. The chromatic figure was regularly formed and presented no special abnormalities. Neither amitosis nor binucleate cells occurred. The chromosomes were normal in number and structure. Spindle

formation was frequently inhibited, in consequence of which the chromosomes failed to separate normally. With the arrest of mitosis further development apparently ceased.

The experiments with strychnin were unsatisfactory. Solutions ranging from o.or to r per cent inhibited mitosis and disorganized the cytoplasm, causing the death of the cells. The nuclei were not deformed and the chromatic figures were normal. Strychnin seems to arrest cytoplasmic activity swiftly, without producing visible changes in the mitotic figure.

As a result of their investigations, certain authors state that nuclei can be made to divide amitotically through the influence of toxic solutions. Others, who used the same technic and methods, deny that such solutions produce amitosis, and find that in every case when division occurred the resulting nuclei were formed only by mitosis. Blazek (3) found that benzol caused the vacuoles in the cytoplasm to increase greatly in size; Nemec (18) observed that chloroform and potassium nitrate produced granulation of the spindle fibers; Wasielewski (30) ascribed doubling of the nucleoli to the action of chloral hydrate; Woycicki (34) states that ether prevented the formation of division walls in dividing cells; and Wisselingh (31) found that under the influence of phenol the cell structures were poorly differentiated.

The authors just cited attributed the above-mentioned abnormalities solely to the action of the toxic substances used. In the experiments described in this paper all these abnormalities were observed in the toxicated material, and also in the controls grown in distilled water. These results appear to indicate that the action of distilled water is a factor which has been overlooked in interpreting the effect of toxic solutions on mitosis, and that numerous abnormalities ascribed to the action of toxic substances are not necessarily so produced.

CONCLUSIONS

1. The practice of growing controls in distilled water, common in certain physiological experiments, is open to serious objections, since these controls are themselves under abnormal conditions, and are subject to the same progressive decline of cell function as occurs in dilute toxic solutions, though at a slower rate.

- 2. Judged by its effect on mitosis, as compared with the effect of dilute solutions of copper sulfate, distilled water is itself a toxic solution. Apparently many abnormalities of cell behavior which have been attributed to the effect of toxic salts may be due instead to the osmotic action of the solution.
- 3. The achromatic structures organized from the kinoplasm are most sensitive to toxic action. Since the spindle fibers are reduced to a granular mass or otherwise disorganized, the further progress of division is inhibited.
- 4. Copper sulfate, phenol, and strychnin, under the conditions of these experiments, produce neither amitosis nor truly binucleate cells.
- 5. No structures occurred in the material studied which the most charitable interpretation could homologize with the large fusion nuclei containing double the normal number of chromosomes, produced, as stated by Nemec, by a copper sulfate solution acting on radicles of *Vicia Faba*.
- 6. Doubling of the nucleolus is not a preparatory stage of amitosis, as stated by Wasielewski.

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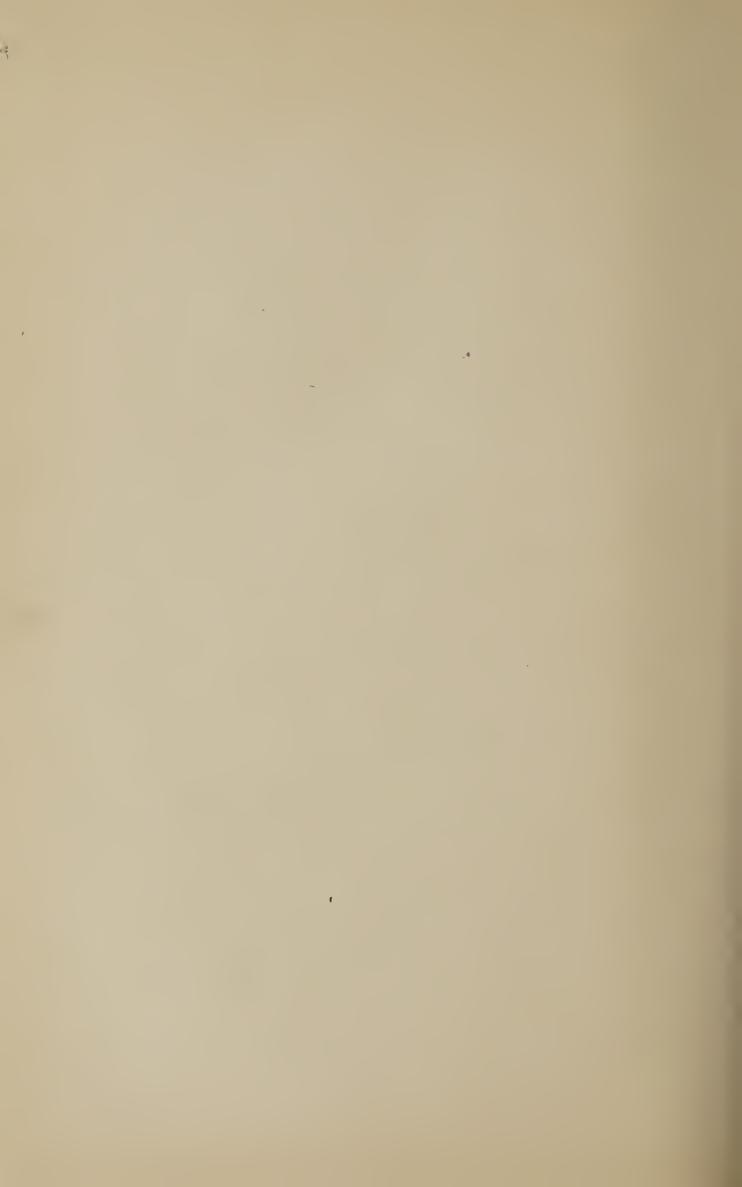
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LITERATURE CITED

- 1. Andrews, F. M., The effects of alkaloids and other vegetable poisons on protoplasm. Proc. Indiana Acad. Sci. 1905:195-196. 1906.
- 2. ——, The effect of gases on nuclear division. Annals of Botany 19: 521-531. 1905.
- 3. Blazek, J., O olivu benzolu na dělení buněk rostliuných. (Ueber den Einfluss der Benzoldämpfe auf die pflanzliche Zelltheilung.) Abh. Böhm. Akad. 11:no. 17. 1902.
- 4. CLARK, J. F., On the toxic effect of deleterious agents on the germination and development of certain filamentous fungi. Bot. GAZETTE 28:289-328, 378-405. 1899.
- 5. CZAPEK, F., Biochemie der Pflanzen 2:928. 1905.
- 6. DAVENPORT, C. B., Experimental morphology 1:25. 1897.
- 7. Demoor, J., Contribution à l'étude de la physiologie de la cellule. Arch. Biologie 13: 163-244. 1894.
- 8. Gerassimow, J. J., Zur Physiologie der Zelle. Bull. Soc. Imp. Nat. Moscow 1904:no. 1. pp. 134.

- 9. Gerassimow, J. J., Ueber die Grösse des Zellkernes. Beih. Bot. Centralbl. 18:45–118. 1904.
- 10. Kahlenberg, L., and True, R. H., On the toxic action of dissolved salts and their electrolytic dissociation. Bot. Gazette 22:81-125. 1896.
- II. KARPOFF, W., La caryocinèse dans les sommets des racines chez la *Vicia Faba*. (In Russian with French résumé.) Ann. Inst. Agronom. Moscow 10:358-384. 1904.
- 12. LAIBACH, F.. Zur Frage nach der Individualität der Chromosomen im Pflanzenreich. Beih. Bot. Centralbl. 22:191-210. 1907.
- 13. LOEW, O., Ein naturliches System der Gift-Wirkungen. München. 1893.
- 14. Mosso, M., Influence des alcaloides sur la germination der graines. Journ. Pharm. et Chim. VI. 3:no. 1. 1896.
- 15. Nägeli, C. von, Ueber oligodynamische Erscheinungen in lebenden Zellen. Denkschr. Schweiz. Naturforsch. Gesell. 33:1-51. 1893.
- 16. NATHANSON, A., Physiologische Untersuchungen über amitotische Kerntheilung. Jahrb. Wiss. Bot. 35:48-78. 1900.
- 17. ——, Kritische Bemerkungen zu VAN WISSELINGH, Ueber abnormale Kerntheilung. Bot. Zeit. 62:17–20. 1904.
- 18. Nemec, B., Zur Physiologie der Kern- und Zelltheilung. Bot. Centralbl. 77:241-251. 1899.
- 19. ——, Die Reizleitung und die reizleitenden Strukturen bei den Pflanzen.
 Jena. 1901.
- 20. —, Ueber ungeschlechtliche Kernverschmelzungen. Sitzb. Böhm. Gesell. Wiss. Prag 1902: Mitt. 59.
- 21. ——, Ibid. 1903: Mitt. 27.
- 22. ——, Ueber die Einwirkung des Chloralhydrats auf die Kern- und Zellteilung. Jahrb. Wiss. Bot. 39:645-730. 1904.
- 23. ——, Ueber die Bedeutung der Chromosomenzahl. Bull. Intern. Acad. Sci. Bohem. 10: pp. 4. 1906.
- 24. Pfeffer, W., Ueber die Erzeugung und physiologische Bedeutung der Amitose. Ber. Verhandl. Königl. Sächs. Akad. Wiss. 51: 4–12. 1899.
- 25. ——, Pflanzenphysiologie 2:333. 1904.
- 26. Sabline, V., L'influence des agents externes sur la division des noyaux dans les racines de *Vicia Faba*. Rev. Gén. Bot. 15:481-497. 1903.
- 27. Schrammen, R., Ueber Einwirkung von Temperaturen auf die Zellen des Vegetationspunktes des Sprosses von *Vicia Faba*. Verh. Naturhist. Vereins Preuss. Rheinland 59:49 ff. 1902.
- 28. Schürmayer, C. B., Ueber den Einfluss äusserer Agenten auf einzellige Wesen. Jenaisch. Zeitschr. 24:402–470. 1890.
- 29. STRASBURGER, E., Ueber die Individualität der Chromosomen und die Pfropfhybriden-Frage. Jahrb. Wiss. Bot. 44:482-555. 1907.
- 30. Wasielewski, W., Theoretische und experimentelle Beiträge zur Kenntniss der Amitose. Jahrb. Wiss. Bot. 38:377-420. 1903; 39:581-606. 1904.

- 31. Wisselingh, C. Van, Untersuchungen über Spirogyra. Bot. Zeit. 60:115-138. 1902.
- 32. ——, Ueber abnormale Kernteilung. 5. Beitrag zur Kenntniss der Karyokinese. Bot. Zeit. 61:201–248. 1903.
- 33. ——, Antwort auf die kritischen Bemerkungen von A. NATHANSON. Bot. Zeit. 62:20–21. 1904.
- 34. WOYCICKI, Z., Ueber die Einwirkung des Athers und des Chloroforms auf die Teilung der Pollenmutterzellen und deren Produkte bei *Larix dahurica*. Bull. Intern. Acad. Sci. Cracovie 1906: 506–553.



LEATHER CHEMISTS ASSOCIATION

ANNUAL MEETING.

The Annual Meeting of the American Leather Chemists Association will be held at Washington, D. C., December 2, 3 and 4, 1909.

DEKKER'S MONOGRAPH OF THE TANNINS.1

By W. W. Stockberger.

The completion of Dr. Dekker's monograph of the tannins makes available a reference work of much value from both technical and purely scientific points of view, although the fact that it is written in the Dutch language will materially reduce its usefulness to a wide circle of readers.

Part I., which appeared in 1006, is devoted to (1) Bibliography, (2) Distribution of tannin among plants, and (3) Physiology.

The bibliography, though not complete, contains approximately two thousand titles and is brought down to 1906. The arrangement of the plant names follows that of the Engler Syllabus. Brief notes giving the sources of the plant, per cent. of tannin when known and references to the bibliography accompany the larger number of species mentioned. Some interesting general conclusions are drawn relative to the distribution of tannin among plants: The *Gymnospermae* are extraordinarily rich in plants with high tannin content; in the *Monocotyledoneae* tannin seldom occurs except in the *Polmae*; in the *Dicotyledoneae* the tannin producing families are very numerous, c.g., very rich in tannin are the *Salicales*, Fagales, Polygonales, Rosales, Geraniales, Sopindales, Myrtiflorae, Ericales and Ebenales.

Under "physiology" the author devotes a chapter to the methods of research, gives a resumé of the literature of the distribution of tannin in the plant and in the concluding chapter discusses the part played by tannin in the plant economy.

Part II., published in 1908, is concerned with (1) Chemistry

¹ Dekker, J., De Looistoffen, botanisch-chemische monographie der tanniden. Bulletin van het Koloniaal Museum te Haarlem, No. 35, 1906, pp. vi + 220; No. 39, 1908, pp. 24r. Amsterdam, press of J. H. de Bussy. Price of each part 1.50 f.



The first chapter of Part 11, presents an historical review of the literature dealing with the chemistry of the tannins and tannoids. This is followed by a chapter of eighty-five pages on "the chemical nature of the tannins," in which are presented the methods of preparation, principal reactions and the chemical composition of the tannins in the chief tannin-producing plant families. In a tabular summary, the various tannins discussed are grouped according to their relationships in a form convenient for reference.

Under "quantitative analysis" seventy-eight methods of estimation are summarized. The work is concluded by a brief chapter on the technical uses of tannin.

ON THE ESTIMATION OF GLUCOSE IN LEATHER.1

By H. G. Bennett.

The determination of glucose in leather is undoubtedly one of the most tedious operations of the leather trades chemist, involving as it does the extraction of the leather with petroleum ether, then with water, and finally the detannization of the aqueous extract. It is evident therefore that there is a need for an accurate and quick method for the actual estimation of glucose in the detannization solution. The L.A. L. T. C. were doubtless wise in deciding that the gravimetric method, being the most accurate, should be the "official" method of the Association, but the writer would venture to suggest that the use of the method of Wood and Berry. (Proceedings of the Cambridge Philosophical Society, Vol. XII, Part II,) should at least be a permissible alternative, as it presents some advantages in rapidity over the gravimetric method.

For the convenience of those who have not come across or used this method, the following short description will perhaps be useful:—

The detamized solution is heated with the Felling's solution in precisely the same way as in the official gravimetric method,

From Collegium



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THE GEOGRAPHIC DISTRIBUTION OF TANNIN PLANTS.1

By W. W. Stockberger,

Bureau of Plant Industry, U. S. Dept. of Agriculture.

The constant increase in the quantity of tanning materials which is being imported into the United States cannot fail to arouse further interest in the source of these products and in the

¹ Read at the A. L. C. A. Convention, Washington, Dec, 5, 1912.

economic conditions prevailing in the countries from which they are derived. Since in recent years important additions have been made to the number of plants recognized as available sources of tannin, further knowledge regarding their abundance and general region of occurrence is naturally very desirable. Also much more definite information is needed concerning the local distribution and commercial range of all important tannin plants before either their economic significance or their practical importance as an available source of tannin for trade uses can be fully determined.

The limits of this brief and general paper will permit the mention of only a few of the salient features of the distribution of tannin plants, with very little discussion of this subject in its practical aspects, although the latter are yearly growing in importance. The significance of certain facts respecting the geographical distribution of tannin plants can perhaps be more fully appreciated if some consideration is first given to the distribution of tannin in the various natural orders and families into which plants have been grouped with respect to their relationships. This is a subject which has received very little attention except for the contribution of Dr. Dekker¹ in his invaluable monograph on the tannins, which has been freely drawn upon in the prepararation of this paper. In Dr. Dekker's work the results of his own extensive researches are so combined with those recorded in the widely distributed literature of the tannins that the whole presents a mass of data from which important generalizations may be made. However, since the number of plants in which the presence or absence of tannin has been determined is relatively small in comparison with the number of known species of plants, it is very probable that these generalizations will be more or less modified by future investigations.

When the groups or subdivisions into which botanists divide the plant kingdom are considered with respect to the occurrence of tannin therein it appears that some forms of this compound appear in all of the main groups of plants, but that in every group there are many families that contain little or no tannin. In the lower groups of plants represented by the algæ, fungi and lichens, tannin is of frequent occurrence but owing to the rela-

¹ Dekker, J., "De looistoffen," Bulletin van het Koloniaal Museum te Haarlem, No. 35, 1906.

tively small mass of plant material furnished by these groups the total quantity of tannin produced is not sufficient to have any commercial importance. In the next group, the mosses, very few plants have been found which give a positive reaction for tannin. The group which includes the ferns has numerous species which vary in tannin content from a mere trace to as much as 10 per cent., but it is in the higher group of seed-plants that tannin occurs most abundantly.

The subdivision of seed-plants, known as the Gymnosperms, contains a large number of plants which have a high tannin content. The most important of these are species of trees such as the pine, hemlock, spruce and fir. On the other hand among the Monocotyledons the number of families in which tannin has been found is small, and of these the Palmæ is the only one in which there are plants which furnish tannin in commercial quantity. Among the hundreds of species of the families which include the grasses, sedges and lilies, the occurrence of tannin even in very small quantities is quite rare.

The last and most important division of the seed-plants, the Dicotyledons, furnish by far the largest number of plants rich in tannin. The respective natural orders comprising the Dicotyledons vary greatly, as has been pointed out by Dr. Dekker, in respect to the manner in which tannin is distributed among the various families. In every order it frequently occurs that of two closely related families the plants of one will be rich in tannin while in the plants of the other, tannin will occur either in very small quantities or not at all. Occasionally there seems to be a gradual variation in tannin content between closely related families. Some natural orders contain no families of plants at present known to produce tannin, and in other orders almost the entire range of families furnish plants containing tannin but in very limited quantities. From the information which is at present available it does not seem possible to establish any very direct correlation between the production of tannin by different families of plants and their relationship to any of the schemes of classification which are in use by modern botanists. Since, however, most of the known facts concerning the distribution and abundance of plants have been collected and arranged with reference to the botanical classification it will be desirable to recognize the usual divisions into orders and families for the purpose of more clearly setting forth the general facts concerning the geographical distribution of plants producing tannin.

Turning now to the actual question of geographical distribution of plants producing tannin, we may at once dismiss from consideration all of those families in the previously mentioned classification other than the seed-plants. We will consider for convenience of discussion each of the three main groups of seedplants, beginning with the Gymnosperms. In this subdivision practically all of the plants known to contain tannin occur in one of four natural orders, the chief of which is the Pinaceæ, to which belong the pines, spruces, hemlocks and firs. The distribution of this group in the northern hemisphere naturally follows closely that of the coniferous forests and aside from the occurrence of a species of Podocarpus, in Southern Africa, and a species of Phyllocladus in Tasmania and New Zealand, there are no important tannin-bearing representatives of the Gymnosperms to be found south of the Equator. The distribution in the Northern Hemisphere coincides in a more or less general way with the principal mountain ranges, the slopes of which are naturally wooded with forests of coniferous trees. This of course tells nothing of the distribution in detail but merely indicates the densest areas on which plants of this group, having a high tannin content, may be found. Scattered generally throughout certain sections of the United States and Mexico, as well as through regions in Central and Northern Europe and Asia, are many tannin-bearing species which belong to this group, but since by far the largest number of important species are included among either the pines, hemlocks or spruces, it follows that the general distribution of this group of tannin plants conforms quite closely to that of these species of trees. So far as known it appears that the tannin-bearing Gymnosperms are practically confined to the north temperate zone, and because of their accessibility and the inroads made upon them in order to meet the increasing demands for timber it is probable that this source of tannin will be one of the first to be exhausted.

The second group of seed-plants, the Monocotyledons, is quite unimportant from the standpoint of tannin, although it contains many hundreds of species of plants which are well known and

widely distributed. Here, as was stated, belong the grasses, of which there are more than 3,500 varieties, but only four or five of these are known to contain tannin. In the one order which contains all of the tannin plants of importance, two only are worthy of mention here. These are the palmetto of Florida and Areca catechu of India, which is one of the commercial sources of cutch. There are 35 other orders in this group, the plants of which are widely distributed, but they are so poor in tannin that from the commercial standpoint at least they cannot be regarded strictly as tannin plants.

The third group of seed-plants, the Dicotyledons, contains by far the greater number of tannin plants. In some of the natural orders of this division tannin producing families are practically wanting, in some the relative number of tannin families is variable, and in others practically every family contains tannin producing plants. A study of those natural orders in which only a part of the families contain plants rich in tannin reveals some interesting facts. Several of these orders are widely distributed both with respect to climatic conditions and continental location. Representative species which contain tannin occur in various situations ranging from the tropics to areas approaching the limits of vegetation toward the poles. However, when the locality is considered, of such plants as have been found to yield tannin in percentages sufficient to make them commercially promising, it becomes evident that with few exceptions they are all to be found in tropical countries. This fact may be concretely illustrated by citing the distribution of some of the more important tannin plants belonging to those natural orders in which there is great variation between families with respect to tannin production. For example, the natural order Urticales has three tannin producing families comprising about sixty species of plants of which those highest in tannin, 4 to 14 per cent., are a few species of Ficus growing in India and the Philippines. In the order Santalales four families together contain about fifteen species of plants which produce tannin, the important ones being species of Osyris and Fusanus from India, Central Africa and Australia, ranging from 15 to 25 per cent. in tannin content. The order Ranales has nine families which together include a hundred species of plants containing more or less tannin; of

these the best known are species of *Persea* in Chili, 17 per cent. tannin; *Nectandra* in Brazil, 10 per cent. tannin; *Nesodaphne* in Australia and *Litsea* in India, both yielding over 7 per cent. tannin. In the order Tubifloræ a large number of tannin containing species is distributed among fourteen families. The important tannin plants are species of *Bignonia* from Guiana, 14 per cent. tannin, of *Eremophila* from Australia and of *Avicennia* from the East and the West Indies. Other orders in which a part of the families have numerous species containing tannin, the important ones of which are largely confined to the tropics, are the Contortæ Aristolochiales, Rubiales, Umbelliflora, Parietales and Malvales.

No less interesting is the distribution of those orders in which practically all the families comprise tannin bearing plants. some of these families the occurrence of tannin is so general that they may be considered as typical tannin families. Examples of such are the Combretaceæ, consisting of about 240 tropical species, one of which yields the myrobalans of commerce; the Rhizophoraceæ which contains about 50 tropical species rich in tannin, some of which yield the mangrove bark; the Leguminosæ with about 6,000 widely distributed species of which many of those rich in tannin, as the wattle, algarobilla, ratanhia, kino and divi-divi, are tropical, and the Myrtaceæ which has at least 100 tannin species, the best known of which is the Eucalyptus, native of Australia. Notwithstanding the wide distribution of these families, by far the greater number of species having a high tannin content occur in tropical or subtropical regions. There are, of course, some exceptions, as, for example, the Fagaceæ, to which the oaks and chestnuts belong, but in general that portion of the several continents lying between the parallels of 30° north and south latitude must be depended upon to furnish the bulk of the supply of commercial tannin.

An enumeration of the various plants which have been used for tanning in different countries would give only an apparent indication of their geographic distribution since a tannin plant frequently occurs in countries where it finds little if any use and perhaps more frequently its greatest use is in countries where it does not naturally occur. In many cases it is equally unsafe to judge of the botanical distribution of these plants from the

localities given as the source of the material used in the analyses reported in the literature of the tannins. The writer recently examined what purported to be a list of the most important tannin plants of the world in which the country where each species occurred was given. On tabulating this list the following distribution of the species was obtained:

India 68	3 species	Chili	3 species
Europe 40) · ''	Brazil·····	
Australia 22	2 "	Argentine	3 "
North America 16	5 ''	New Zealand	3 ''
Africa	9 ''	Peru	2 "
Central America.	7	Guiana	2 "
China	3 ''	Asia · · · · · · · · · · · · · · · · · · ·	2 "
Japan	3 ''	Mexico	I "

A number of reasons might be given for the apparent inequality in distribution shown by this compilation but it will suffice to say that botanical exploration, particularly with respect to economic plants, has been carried much further in India and Australia than in other tropical countries, and that when these countries shall have been fully explored substantial additions will probably be made to their lists of tannin plants. In this connection mention may be made of a note by the writer in the JOURNAL of this Association¹ in which attention is called to thirty-five species of tannin plants in Paraguay, only one of which is referred to Paraguay in most of the literature on tannins.

The present state of knowledge with respect to the distribution of tannin plants leaves much to be desired. The lack of information is not confined to the conditions in the less accessible tropical countries alone, but is evident also wherever it becomes desirable to secure full details concerning the production, handling and utilization of any tannin plant. In the judgment of the writer there is less need for concern regarding the possible exhaustion of the natural supply of tanning materials than for a practical solution of the problem of how to bring them into the market on terms that do not work a hardship either to producer or to consumer. So long as these materials can be obtained from untilled or untillable areas of land with the assistance of low priced labor their production as an agricultural crop will prob-

¹ Stockberger, W. W., Tannin Plants of Paraguay, Journal of the American Leather Chemists Association, April 1912, p. 185-192.

ably be very limited. But should economic conditions so change as to enable certain tannin plants to compete successfully with general field crops there is no doubt that large quantities of tanning materials could then be produced on an agricultural basis. It follows, then, that the practical importance of a thorough study of the geographic distribution of tannin plants is two-fold, first, since it will yield more definite information concerning the location and available quantity of existing tannin materials, and second, since it alone can furnish a rational basis for extensive experiments having as their aim the introduction of tannin plants into our present system of agriculture.

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THE PRODUCTION OF NEW TANNING MATERIALS IN THE UNITED STATES.

By W. IV. Stockberger.

The cultivation of useful plants probably originated when man felt the necessity of replacing the depleted supply of natural growth and of increasing the quantity available for his use. There is little doubt that certain food plants were first domesticated and that as civilization advanced and the need of man and his desire for additional means of solace and comfort increased, to these there were added plants yielding the fiber for textile fabrics, the dyes with which they were colored, drugs prized for their curative or narcotic properties, and the numerous other products for which human ingenuity has devised a use.

In the list of cultivated plants which now reaches far into the thousands there are some that have been domesticated for centuries, others that came into use at various periods of our recorded history, and still others that are being introduced to cultivation with each succeeding year. In studying the conditions existing at the time when many of these plants were introduced the operation of certain economic principles becomes apparent which I shall endeavor to illustrate briefly. I shall take for one example *Hevea brasiliensis*, one of the plants which produces the crude rubber of commerce. In the earlier stages of the collection of this product it was the custom to rely solely upon plants growing in their native wilderness. The milky juice of this plant

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was collected by methods that were at once crude and wasteful, as well as eventually destructive to the life of the tree. So long as virgin areas remained which could be drawn upon at will, little or no attention was paid to the conservation of the natural supply. But as the uses for rubber developed and the world's market demanded year by year an increasing supply, it became evident that in a few years there would be a general shortage of this valuable commodity. Attention was then directed to the cultivation of this plant, not only in its native region but in some of the tropical countries of the eastern hemisphere. So successfully has this plant been domesticated that it is probable that in a few years our entire supply will be derived from cultivated sources. Another example is afforded by the camphor tree, Cinnamomum camphora, indigenous in Japan and Formosa. In the early stages of the camphor industry mature trees were felled in the native forests and the wood subjected to crude and wasteful methods of distillation. In time it came to be recognized that the natural supply was becoming exhausted and a law was promulgated in Japan requiring that a new tree should be set out for every one cut down. In this manner the tree was there introduced to cultivation. During recent years the demand for camphor has enormously increased, owing to its extended use in the arts, and the cultivation of this tree has been begun in regions where it is not native. In our own land experiment has shown that camphor can be obtained from leaves and twigs removed as prunings without destroying the life of the tree, and in Florida an extensive tract of land is being set with camphor trees by the Satsuma Company for the commercial production of camphor along the new cultural lines indicated.

A third example is afforded by a class of plants which forms the source of supply for certain crude drugs. Among these the most striking for the purpose of my illustration is *Hydrastis* canadensis, or golden seal, the source of the important alkaloid hydrastine. While for many years golden seal has fluctuated widely in price, according to the relative amounts existing in the markets, the continued high prices of the last few years seem entirely due to the fact that the plant is becoming rapidly exterminated. As a consequence of the diminishing wild supply

and the continued high prices, cultivation of the plant has been begun at several points in the Eastern States.

One of the principles which these examples illustrate I have formulated for reference later as follows: An economic plant will be brought under successful cultivation only when the natural supply becomes exhausted or difficult to obtain and when the returns from its cultivation offer a fair remuneration to the cultivator for his investment and labor.

Before attempting to introduce to commercial cultivation a plant which occurs only in a wild state or which may be domesticated only in a region remote and widely diverse from the one in which the introduction is to be made, a careful study should be given to the economic, geographic, climatic and agricultural conditions which will affect the new enterprise. It is to a consideration of these conditions with reference to "The Production of New Tanning Materials in the United States as an Agricultural Industry," that I now wish to direct your attention.

The annual Federal reports on the statistics of forest products furnish much valuable information on the production and consumption of tanning materials in the United States. From these it appears that there is a strong tendency toward the diminished use of barks, while the use of extracts has increased very rapidly. The reported consumption of tanbark in 1908 was 7.5 per cent. less than in 1907, which in turn was 11.4 per cent. less than the consumption in 1906. On the other hand the quantity of extract used in 1908 was 7.5 per cent. greater than in 1907, when the quantity consumed was 10.8 per cent. greater than in 1906. In view of the apparent growing scarcity of native bark, the use of which is being rapidly supplanted by extracts, the following excerpt from the last of the reports referred to is of much interest:

"Of the extracts used in 1908, chestnut and quebracho were the most important, together forming 74 per cent. of the total quantity reported for that year. The quantity of chestnut extract used in 1908 was nearly 12,000,000 pounds more than that used in 1907, the increase amounting to 8.9 per cent., while in the same period the quantity of quebracho showed a decrease of about 2,150,000 pounds, or 1.5 per cent. There was a decrease of about 9,000,000 pounds, or 29.6 per

cent. in the quantity of oak extract reported, and a slight increase in that of hemlock. The increase in the case of 'all other' kinds was most apparent, amounting in quantity to 26,125,000 pounds, or 196.4 per cent., and in value to \$789,969, or 166.9 per cent., and was due largely to the greatly increased use of myrabolam and mangrove extracts."

The reported cost of tanbark and tanning extracts consumed in the United States for each of the past five years is approximately \$21,000,000. During the same time the total value of imports has risen from \$534,552 in 1904, to \$3,580,959 in 1908. The following table compiled from data supplied by the Bureau of Statistics, U. S. Department of Agriculture, presents in detail the course of importations of tanning materials for the years mentioned.

From the facts represented by these figures the inference may be drawn that certain conditions now exist that should stimulate interest in a search for new tanning materials. The time is not far distant when our once plentiful supply of hemlock and oak bark will be exhausted. The increase of 12,000,000 pounds in the quantity of chestnut extract used in 1908 indicates that this source is being drawn upon heavily. Also the heavy increase in importations, which in 1908 were valued at more than six times as much as those in 1904, apparently indicates either that our native materials are rapidly diminishing or that the cost of producing them has so advanced that it is cheaper to depend upon foreign sources of supply. A timely subject, therefore, for the consideration of Americans is whether there are not now undeveloped sources of native tanning materials which can be utilized or whether some of the profitable tannin plants of other lands may not be introduced to cultivation in this country.

The prospect of producing tannin-bearing plants on an agricultural basis is one of growing promise. The introduction and increased use of extracts and the wider employment of a mixed tannage should make it much easier for new materials to gain a footing if they prove to be at all satisfactory. The increase in our knowledge of the chemistry of leather making and of the wider adaptations of which various tanning extracts are capable, due to the indefatigable industry of our leather chemists, en-

IMPORTATIONS OF TANNING MATERIALS INTO THE UNITED STATES, 1904-1908.

				Y	Year ending June 30,	te 30,				
Hemlock bark	1904 Quantity Cords	value Dollars	1905 Quantity Cords	Value Dollars	1906 Quantity Cords	Value Dollars	1907 Quantity Cords	Value Dollars	1908 Quantity Cords	Value Dollars
	14,111	63,460	13,511	64,181	7,467	35,860	6,744	30,757	8,868	43,890
Mangrove bark	Tons (b)	Dollars (b)	Tons (b)	Dollars (b)	Tons (a)	Dollars (a)	Tons 20,693	Doilars 426,431	Tons 15,192	Dollars 310,745
	Pounds (b)	Dollars (b)	Pounds (b)	Dollars (b)	Pounds (b)	Dollars (b)	Pounds 79,033,584	Dollars 2,319,785	Pounds 79,186,787	Dollars . 2,260,364
Quebracho wood . Tons	Tons (a)	Dollars (a)	Tons (a)	Dollars (a)	Tons (a)	Dollars (a)	Tons 66,810	Dollars 840,779	Tons 48,871	Dollars 612,971
Sumac, ground Pounds 18,604,644	Pounds Dollars 18,604,644 276,891	Dollars 276,891	Pounds 15,583,334	Dollars 225,036	Pounds 15,131,539	Dollars 2 37,309	Pounds 12,487,103	Dollars 267,239	Pounds 8,576,091	Dollars 227,611
Other tanning materials		Dollars 194,201		Dollars 923,949		Dollars 1,419,962		Dollars 84,406		Dollars 125,378
Total		534,552	I	1,213,166		1,693,131		3,969,397		3,580,959
(a)—Inclu	(a)—Included in "Other tanning materials."	ner tanning	materials."	(b)—Not stated.	t stated.					

a)—Included in "Other tanning materials." (b)—Not stated.

courages the belief that a use will be found for every plant that can be shown to yield tannin in commercial quantities.

The geographical location of any region or section has a distinct bearing upon its agricultural possibilities. The prospects are much more encouraging for a section located where transportation is cheap and where there is direct access to the markets which may absorb the bulk of the products of the land. When other conditions are equal the advantage will lie with the section which has the best railway facilities or which enjoys the advantages of water transportation. So long as the freight rate by rail from the middle West to New York is as great as that on the same class of material brought to New York by water from points on the eastern coast of Africa, the latter are at no disadvantage on account of the greater distance from the market. On the other hand the hemlock bark of Oregon can not be brought to the eastern markets on a parity with the local product on account of the dis-parity in freight rate due to the distance the former must be carried. This condition would limit the marketing of almost any tanning material produced on the Pacific Coast largely to local needs. The most advantageous location for the production of tanning materials would seem to be near large centers of consumption. The states in which these are located may be learned from the statement of the quantity of bark and extract used in 1908. The largest consumption of tan bark was reported from Pennsylvania, Wisconsin, West Virginia, New York and Virginia, in the order named; and of extract from Pennsylvania, Massachusetts, New York, Michigan and Wisconsin, also ranking in the order named. Of the total cost of tanbark and tannin extract 33.3 per cent. was reported from Pennsylvania alone. It does not follow from this, however, that Pennsylvania is the most favorable location for the cultivation of tannin plants as further considerations will show.

Although the distribution of tannin bearing plants is very wide and is apparently independent of climate, yet due consideration must be given to the fact that a large number of the plants yielding high percentages of tannin are native of the warmer regions. Among these may be mentioned quebracho, catechu, gambier, wattle, myrabolams, divi-divi, canaigre, ratanhia, mo-

nesia, mallet and churco barks. Many other plants also, which have a high tannin content and seem promising subjects for introduction to cultivation in this country, will survive only a slight degree of cold. It is not intended to convey the impression that tannin bearing plants can not be grown in the more northern portions of the United States for such is not the case, but the balance of evidence at present, subject to revision through experiment, indicates that favorable results may be best anticipated in the warmer southern sections.

The general agricultural conditions in the various sections present a weighty factor that must be reckoned with. The price of land, the cost of labor and the value of the staple crops now being produced will quickly determine the fate of a new introduction. The present tendency toward intensive agriculture under which very large returns are frequently derived from a small area, robs the holder of fertile and highly productive lands of any interest in low priced crops. Should the cultivation of tannin bearing plants in the United States be undertaken on a scale commensurate to supply the demand in this country, it is apparent that a large area of relatively good land favorably located as to transportation facilities would be required. It is also evident that a crop of this kind must be at least as profitable as those now produced in order to receive any consideration from the prospective grower. At present there are no actual data available which throw much light on the subject of probable returns to be anticipated from the cultivation of tannin plants in this country and the same can be secured only through experiments carried out on a commercial scale.

A consideration of the several factors mentioned leads to the conclusion that certain localities in the Southern States offer the best conditions under which to make practical tests of the possibility of cultivating tannin plants on a commercial basis since there considerable areas of relatively cheap land are to be had, the cost of labor is not prohibitive and the distance is not great from the centers of consumption. There also large areas may be obtained which could be devoted to the cultivation of one or more tannin bearing plants on a large scale with a corresponding saving in certain items of the cost of production and marketing.

Aside from the attempt made a number of years ago to cultivate the canaigre practically no work has been done on the cultivation of tannin plants in the United States. The presence of tannin has been demonstrated in many of our native plants and at one time or another a number of these have been utilized in tanning but the supply has been derived from uncultivated material. Preliminary experiments are now under way which it is hoped will yield the data necessary for planning larger experiments on a commercial scale. A survey of the native plants with respect to their availability for cultivation as tannin producers is now in progress and importations are being made from abroad of those tannin plants which seem adapted for cultivation in this country. A discussion of some of the more promising of these will serve to indicate the direction in which work is being carried out.

SUMAC.

The bulk of the sumac used in this country is obtained from abroad, largely from the Mediterranean region, and was imported in 1908 to the extent of 8,576,091 pounds. The cause of the preference in favor of the imported product is generally understood to be due to the presence of undesirable coloring matter in the American sumac. Although the native wild supply is held by some to be more than sufficient to satisfy the present demand it is believed that by cultivation the quality can be much improved and a wider market secured. Two species of sumac, Rhus glabra and Rhus copallina, occur in the region where the American material is gathered and are not distinguished by many collectors. The former known locally as smooth or white sumac contains from 15 to 25 per cent, tannin and the latter called black sumac has yielded on analysis as high as 38 per cent. Leaves of the latter also from certain localities produce a much whiter colored leather than the ordinary product. If the requisite areas of tillable land can be had in localities where the soil and climatic conditions are suitable for maintaining the high tannin content and good color value of the black sumac, proper cultivation and handling may develop a product that will be of high value. The plant is easily cultivated and when two years old may be readily harvested by an inexpensive method that has been used abroad

which consists in mowing over the branches as is done with grass in making hay, and after the leaves are carefully dried removing them from the branches by thrashing. The average yield of Sicilian sumae is only about 2,500 pounds per acre but as this plant does not require a rich soil it may be made to yield a relatively fair return in certain sections where it would not have to compete with other crops of high value.

THE PECAN.

Although the pecan at present promises only a very small supply of material suitable for use in tanning yet it is not devoid of interest. The bark of the tree has yielded 12 per cent. of tannin which appears to produce a soft, light colored leather. The shells also which are to be obtained in some quantity at the centers where the nuts are cracked contain about 9 per cent. tannin which gives a reddish cast to leather. As the shells are at present a waste product they could probably be obtained at a low figure and utilized in certain cases where mixed tannage is employed.

PURSHIA TRIDENTATA.

This is a shrub belonging to the natural order Rosaceae and occurs on dry hills from Montana and Washington to New Mexico and California. In many places it occurs as a small growth scatteringly distributed on hill sides but it is very abundant and of large size in south-central Utah. It has been found to contain 12 per cent. tannin but the distance of the source of supply from the centers of consumption makes its utilization doubtful.

ALGAROBILLA.

The shrub Caesalpinia brevifolia, the pods of which are known as algarobilla, is a native of Chile where it attains a height of about six feet. The pods have been found to contain as much as 67 per cent. tannin which much resembles that of dividivi and myrabolams. The yield has been estimated at six to eight pounds per plant when 1,000 plants were set to the acre. The Chilean product is said to have been sold in European markets¹ at 15 to 25 francs per 100 pounds, which would indicate a gross return

¹ Albert, F., La Algarobilla, 1901.

of at least \$180 per acre. Since this plant requires an arid soil and does not withstand frost, it probably cannot be grown in the United States except along the Mexican border.

DIVI-DIVI.

The pods of Caesalpinia coriaria, known locally as divi-divi, libi-divi or cascalote, contain from 30 to 50 per cent. tannin. The plant occurs wild in Mexico and Central America and is cultivated in Jamaica, Curaçoa and in Mombo, East Africa. Since its range extends only to about 30° from the equator it can be grown only in the extreme southern part of the United States if at all. The natives of Mexico claim that trees will begin to bear fruit when between 7 and 10 years of age and that a large tree will produce from 100 to 200 pounds of pods. Seeds of this tree have been planted in Florida and in time it is hoped that some exact information may be obtained as to its possibilities.

ELEPHANT-ROOT.

The elephant-root, *Elephantorrhiza burchelli*, is a somewhat shrubby leguminous plant, native in South Africa. It grows best there along water-courses but occurs on the drier uplands also. The large, club-footed roots attain a length of several feet, and, when air dry, have been found to contain from 12 to 22 per cent. tannin. Used as a tanning material these roots produce a soft and light-red-tinted leather, somewhat lighter colored than that tanned with wattle bark. The plant will bear some frost and its availability will be tested in suitable localities.

EUCALYPTUS.

During the past few years a great impetus has been given to the planting of Eucalyptus trees as a future source of timber supply. These trees should also be considered as one of the possible new sources of tannin in this country. While the tannin content of all the species and varieties that are adapted for planting in favorable locations in the United States has not been determined, the figures that are available show that the bark of nine contain tannin in amounts varying from 8 to 40 per cent., and that the leaves of eleven species yield tannin in quantities ranging from 6 to 18 per cent. The bark of Eucalyptus

occidentalis, which is exported from Australia under the name of mallet bark, is the richest in tannin, containing according to Dekker 40 to 50 per cent. The leaves are said to have been used in tanning with very good results. The leaves of a species growing in Florida, Eucalyptus robusta, have yielded 17 per cent, tannin and offer a promising subject for experiment. trees of these species send up sprouts very readily after the seedling trees are cut off, it should be possible to obtain at least an annual crop of leaves, either by cutting over the young growth, as was suggested in the case of sumac, or by planting the trees close together in rows and pruning as a hedge. would materially diminish the long period without financial return between planting and maturity of the trees when they are intended for lumber production. A few trees have been planted experimentally in the South from which it is hoped data may be secured as to the probable yield of leaf per acre that may be produced under the method of pruning just mentioned.

It is only just to say that these analyses and color tests were made by Mr. Alsop, and are interesting from the standpoint of practical tests.

Examples enough have been mentioned to show the nature of this work and the direction it is taking. Believing that the time is at hand when we may well attempt to introduce to cultivation tannin bearing plants we are at once confronted with the necessity of obtaining exact and definite information concerning all those that seem to offer a prospect of being adapted to our economic and agricultural conditions. For the most part this work is prospective entirely and before we can hope to proceed far a series of extended and I regret to say laborious experiments on a commercial scale are absolutely necessary. To this end the interest and close co-operation of the tanner, the chemist, the farmer and the agricultural scientist are necessary. If the tanner on the one hand withholds his support until he is assured that these new materials have been tested, proved to be satisfactory and are readily available in hundred ton lots, and the farmer on the other hand declines to become interested until he can be assured of the yield per acre and the f. o. b. price of his crop at his railway siding, nothing will be accomplished. But if the

tanner is willing to give some time and expense to testing small quantities of new products and if the farmer will assist in determining the possibilities of their commercial production, some definite results may be accomplished. Meanwhile such experimental work will be carried on as time and means may permit. Your earnest co-operation will greatly further its progress.

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TANNIN PLANTS OF PARAGUAY.

Exhibited at the International Agricultural Exposition, held at Buenos Aires, 1910.

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The tannin plants discussed in this paper comprise those listed in the catalogue of the Paraguay exhibit¹ at the International Agricultural Exposition, Buenos Aires, 1910. Some of the species mentioned occur in other countries and certain ones have been more or less thoroughly examined with respect to their possible utilization as a commercial source of tannin. Supplementary notes on these and some related species have been added. The plants are arranged according to the family to which each belongs, and the italicised specific name of each is followed by the native name in parenthesis. Percentages of tannin refer to the bark except where otherwise stated.

Following is the list of plants:

FAMILY PALMAE.

Cocos romanzoffiana Cham. (Pindo) contains 6.6 per cent. tannin, used by the natives to tan fine hides. A palm-tree abundant in all the forests along the coast where it is inconsiderately destroyed in order to obtain the leaves which make fine green forage for the droves of mules used by the lumber firms.

¹ Catalogo descriptivo de los productos expuestos por la Estacion agronómica de Puerto Bertoni, Paraguay, Asuncion, 1910.

FAMILY ANONACEAE.

Rollinia sp. (Aratikú gwazú) contains 4.2 per cent. tannin. A tree, often quite tall, common in the forests and well known for its fruit. The thin bark abounding in bast fibers is easily removed. Color when freshly broken, grayish.

The bark of R. salicifolia Schlecht., which occurs also in Brazil, is used as an astringent. According to Peckholt² the leaves and roots of the Brazilian species R. sieberi D. C., and the unripe fruit and bark of R. exalbida Mart., are used as astringents.

FAMILY LAURACEAE.

Ocotca sp. (Yhvá-ikâ) contains 10.8 per cent. tannin accompanied by a mucilaginous substance in large proportions. The bark contains few fibers, and the color when freshly broken is gravish. A stout tree, often quite tall, common in the forests of Paraguay, utilized at times for its timber.

A species of this genus, O. bullata E. Mey., which occurs in Cape Colony, South Africa, contains according to Juritz³ 5.8 per cent. tannin.

FAMILY CAESALPINIACEAE.

Apuleia praecox Mart. (Yhvihrá-perè) contains 10.7 per cent. tannin. Bark smooth, somewhat difficult to remove, color when freshly broken pale vellow. A stout tree, fairly common, used for lumber.

Copaifera lansdorfii Desf. (Kupaih) contains 16.6 per cent. tannin and a certain proportion of resinous matter. Bark thick, ligneous, the corky layer readily breaking into small fragments, fracture whitish red. A tree with well developed trunk, abundant in the forests along the course of the river Mondá-íh, rare in other places. It is from this tree that the Jesuit Missionaries extracted a fragrant balsam known in commerce under the name balsam copaiba.

In Guiana the bark of C. bractcata Benth, is said to be used

² Peckholt, Th. "Heil- und Nutzpflanzen Braziliens aus der Familie der Anonaceae," Berichte d. deut. Pharm. Ges., 1897, p. 450.

³ Juritz, C. F., "Noodzakelijkheid voor georganiseerd scheikundig onderzoek in de Kaapkolonie: looistofbepalingen," Landbouwjournaal Kaap de Goede Hoop, 1905, p. 538.

Nie lerlein, G., "Ressources végétales des Colonies françaises," Paris,

FAMILY MIMOSACEAE.

Enterolobium timboüva Mart. (Timbó) contains 22.3 per cent. tannin and a certain quantity of resinous matter. Bark thick with corrugated epidermis and woody bast, fracture of the young bark white, mature bark reddish. A tree frequently attaining a very large size, quite common, and utilized for lumber. Regarded by the natives as a superior tanning material which gives a special quality to the leather.

The bark and pods of *E. cyclocarpum* (Jacq.) Griseb., occurring in Mexico and Central America, are said to be rich in tannin.

Inga affinis D. C. (Ingá gwazú) contains 25.8 per cent. tannin. Bark smooth, brittle, very deficient in bast fibers, easily separated from the trunk, fracture whitish red. A tree, sometimes quite stout, growing in profusion on the banks of rivers and small streams.

Mimosa sp. (Yukeri guazu) contains 10.8 per cent. tannin. Bark thick, epidermis somewhat corrugated and quite ligneous, fracture dark red. A tree with spiny branches, common in certain places.

The roots of the Indian species M. pudica L. contain 10 per cent. $tannin^5$ and the bark of M. farinosa Gris. from Argentina yields 3.9 per cent. In China the bark of M. sensitiva L., which occurs in Central America and the East Indies, is used as an astringent.

Peltophorum dubium Taub. (Yhvihrá puihtâ) contains 31.2 per cent. tannin and a large quantity of coloring matter. Bark thick and corrugated, exceedingly ligneous, éasily detached from the trunk in long strips, fracture red. A tree, widely used for timber, at times reaching an extraordinary size, common throughout the entire region.

Piptadenia rigida Benth. (Kurupaih-râ puihtâ) contains 28.2 per cent. tannin and coloring matters in moderate proportions. Bark ligneous, epidermis checked and corrugated, easily detached from trunk, fracture pale rose. A tall tree at times rivalling the

⁵ Hooper, D., "Indian tanning materials," Amer. Jour. Pharm., Vol. 24, 1894, p. 377.

⁶ Levi, L. E. and J. F. Sigel, "Analysis of Cuban and Argentine barks, woods, leaves and fruits," *Hide and Leather*, 1905.

⁷ Dekker, J., Bull. Kolo. Museum, Haarlem No. 35, 1906, p. 127.

large cedars in size. Another common species known as Kurupaih-râ morôți is equally rich in tannin.

The bark of *P. cebil* Gr., from the Argentine, is reported to contain 15 per cent. tannin.⁸

FAMILY FABACEAE.

Dalbergia sp. (Yhsapih-ih) contains 5.8 per cent. tannin. Bark smooth, easily removed, slightly ligneous, fracture blackish. A stout tree which is very abundant.

A decoction of the bark of the Indian species *D. latifolia* Roxb., according to Dekker,⁹ is very astringent.

FAMILY MELIACEAE.

Cabralca sp. (Cancharana) contains 5 per cent. tannin in the young bark. Mature bark rather thick, somewhat fibrous, a little hard to remove and of whitish fracture. A well-developed tree, used at times for lumber, profusely abundant in the forests.

"Cedrcla tubiflora" (?) (Cedro) contains 12.6 per cent. tannin. Bark quite thick, composed of tenuous and fibrous layers superposed; corky portion fissured; easily removed, fracture irregular, reddish. A tree common in the entire region, widely used for timber. Two other species also occur which contain about the same per cent. of tannin.

Guarea sp. (Guaré) contains 10.02 per cent. tannin. Bark ligneous, easily removed, fracture whitish. A tree of medium development, abundant.

Among other species of this genus containing tannin are G. grandiflora D. C., Java, and G. trichilioides L., Guiana, the bark of which is used in tanning.¹⁰

Trichilia hicronymi Griseb. (Kaátiguá morôtî) contains 23 per cent. tannin and a large proportion of coloring matter in the bark, which is smooth, readily removed in longitudinal strips, easily broken. The fracture is whitish red. A small tree common everywhere, the bark of which is frequently used by the natives to tan hides and to due cotton fabrics a yellow rose color.

⁸ Levi, L. E. and J. F. Siegel, "Analysis of Cuban and Argentine barks, woods, leaves and fruits," *Hide and Leather*, 1905.

⁹ Dekker, J., "De looistoffen," Bulletin Koloniaal Museum, Haarlem, No. 35, 1906, p. 132.

10 Höhnel, F. R. von, "Die Gerberinden," Berlin, 1880.

Trichilia catigua A. Juss. (Kaátiguá puihtâ) contains 20.5 per cent. tannin and a heavy proportion of coloring matter. Fracture of the bark, dark orange. In other respects like the preceding but somewhat less appreciated as a tanning agent, since it gives a harshness to the leather.

FAMILY EUPHORBIACEAE.

Alchornea triplinervia Muell. (Tapiá gwazú-íh) contains 11.7 per cent. tannin. Bark quite thick, without bast fibers, texture granulose and fragile, easily removed, fracture reddish. A well developed and abundant tree.

"Croton succirubrum" (?) (Sangre de Drago) contains 11.7 per cent. tannin and a resinous matter of a penetrating odor. Bark smooth, thin, quite fibrous, easily removed from sap-wood, fracture white. A-small tree, abundant along the rivers but rare in the forests of the uplands.

FAMILY SAPINDACEAE.

Allophylus edulis Radlk. (Kôkû) contains 10 per cent. tannin. Bark smooth, thin, without bast fibers, somewhat adherent to the sap-wood whence very difficult to remove, fracture yellowish white. A small tree common in certain places but of scant development.

Cupania uraguensis Hook & Arn. (Kambuatâ) contains 17.5 per cent. tannin. Bark rather thick, ligneous, very adherent to the sap-wood, removable only in small pieces by hammering, fracture reddish. A tree of moderate dimensions, characteristic of the forests bordering the rivers and small streams.

Cupania vernalis Cambess. (Yaguarataíh) contains 15 per cent. tannin. Bark smooth, somewhat ligneous, easily removed in large strips, fracture pale rose. Small tree more common than the preceding species.

Cupania sp. (Cedrillo) contains 15.8 per cent. tannin. Bark thin, fibrous, somewhat adherent to the sap-wood, fracture whitish rose. A small tree of scanty development, usually growing in low places on banks of rivers and small streams. Preferred by the natives for tanning fine skins.

FAMILY GUTTIFERAE.

Rhecdia brasiliensis Planch & Trianan. (Pakuri) contains 21.6 per cent. tannin and a small proportion of resinous and coloring matters. Bark smooth, easily removed, brittle, fracture pale red. A fruit-bearing tree, well known, and common in the forests, height ranging from 12 to 14 meters, but small in diameter.

FAMILY MYRTACEAE.

"Britoa fragrantissima" (?) (Yhváviró) contains 9.2 per cent. tannin. Bark smooth, thin, somewhat fibrous, easily removed, fracture whitish. A small fruit-bearing tree of small development. Grows in abundance at times in the old "capueras."

"Campomanesia guavirá" (?) (Yhvávirá) contains 11.6 per cent. tannin. Bark thin, fibrous, difficult to separate from the trunk, fracture whitish yellow. A fruit-bearing tree known and esteemed in all parts of the country, frequently reaching large size, common everywhere.

Eugenia brasiliensis Lam. (Yhvá-poroitih) contains 43.4 per cent. tannin in the mature bark, 16.6 per cent. in the dry leaves and 11.6 per cent. in the wood with little resinous and coloring matter. Bark whitish externally, smooth; without bast fibers, very adherent to the sap-wood, especially when the flow of sap is scanty, fracture color of hazel-nut. Well known fruit-bearing tree from 5 to 10 meters high, 30 to 45 cm. in diameter. Abundant in the forests where in certain low places it forms dense thickets.

Eugenia michellii Lam. (Nangapirih gwazú) contains 28.5 per cent. tannin and very little other extractive matter. Small tree 5 to 7 meters high, small diameter. Bark smooth and thin, somewhat ligneous, fracture whitish. Abundant in low grounds, on banks of small streams and rivers, together with other species of the same genus, similar and all more or less tanniferous.

Eugenia pungens Berg. (Yhvá viyú) contains 10.8 per cent. tannin. Bark thin, smooth, exceedingly adherent to the sapwood and very difficult to remove, texture fragile, fracture cinnamon color. A fruit-bearing tree, as well known and valued as E. brasiliensis, but larger in size and less common.

Eugenia sp. (Regalito) contains 15.8 per cent. of very pure

tannin. Bark smooth, not very thick, adherent to the sap-wood, removable only in small pieces, fracture color of hazel-nut. A small tree 5 to 7 m. high, 15 to 25 cm. in diameter. Less abundant than the other species of the same genus.

Eugenia sp. (Yhvájhay puihtâ gwazú) contains 28.7 per cent. tannin. Bark smooth, thin, without bast fibers, easily removable, fracture whitish. A tree 10 to 12 meters high, 30 to 50 cm. in diameter, not very abundant.

This genus is widely distributed and many of its species contain a relatively high per cent. of tannin. Hooper¹¹ found 19 per cent. in the bark of *E. jambolana* Lam., from India, 12.4 per cent. in *E. jambos* L., from Brazil, 16.1 per cent. in *E. arnottiana* Wight, 11.9 per cent. in *E. montana* Wight, and 10.1 per cent. in *E. caryophyllifolia* Wight; Maiden¹² reported a content of 16.9 per cent. in the bark of *E. smithii* Poir, from Australia, and Höhnel¹³ 16 to 17 per cent. in *E. maire* A. Cunn., from New Zealand. The bark of *E. operculata* Roxb., from Sumatra, according to Bernardin,¹⁴ and that of *E. ovigera* Brongn. and Gr., from New Caledonia, according to Niederlein,¹⁵ is used for tanning.

"Myrtus cdulis" (?) (Yhvá mbopi) contains 21.8 per cent. tannin. Bark thin, smooth. Somewhat difficult to remove, fracture whitish.

FAMILY SAPOTACEAE.

Bumelia obtusifolia R. and S. (Pihkasúrembiú) contains 8.4 per cent. tannin. Bark smooth, somewhat ligneous, easily removed, fracture whitish yellow. A tree of moderate size, somewhat abundant.

FAMILY APOCYNACEAE.

Aspidiosperma polyneuron Muell. (Palo Rosa) contains only 2.6 per cent. tannin. The wood contains a pink coloring matter

¹¹ Hooper, D., "Indian Tanning Materials," *The Agricultural Ledger*, Calcutta, 1902, No. 1.

¹² Maiden, J. H., "The Useful Native Plants of Australia," London, 1889, p. 327.

13 Höhnel, F. R. von, "Die Gerberrinden," Berlin, 1880.

Bernardin, M., "Classification de 250 matières tannantes," Ghent, 1872.

Niederlein, G., "Ressources végétales des Colonies françaises,"

Paris, 1902.

of possible usefulness. A tall, stout tree, yielding excellent timber, at present neither well known or much used. Found only in some places in Paraná north of the parallel of 26°.

The White Quebracho, A. quebracho-blanco Schlecht., from the Argentine, contains in the wood about 3 per cent. tannin, in the leaves 27 per cent. and in the bark 4 per cent. ¹⁶

FAMILY BIGNONIACEAE.

"Tecoma ipé araliácea" (?) (Lapacho) contains 5 per cent. tannin. Bark thick, bast fibers abundant, epidermis and corky portion cracked or fissured, easily removed, fracture whitish. A well known and common tree, one of those most used for timber.

According to Niederlein¹⁷ the bark of T. leucoxylon Mart., from Guiana, is used in tanning.

U. S. Dept. of Agriculture, Bureau of Plant Industry.

¹⁶ Möller, Jos., "Ueber das Quebrachoholz," *Dingler's Polytech. Journ.*, Vol. 230, 1878, p. 481, 845.

¹⁷ Niederlein, G., "Ressources végétales des Colonies françaises," Paris, 1902.



